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THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

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TRANSACTIONS AND PROCEEDINGS OF THE SOCIETY.

Some of the early volumes of the Society's Transactions are out of print. Any single volume of the years 1868–1887, is sold at 10*s.* to Fellows. The volumes for 1868–1900, in sets of not less than five, as well as the five of the Third Series (1862–1867), can be obtained by Fellows at greatly reduced prices on application to the Secretary. The following is a price list of recently published parts—

1933.—Transactions, Vol. LXXXI: Part I, £1 4*s.* 0*d.*, to Fellows, 18*s.* 0*d.*; Part II, £1 4*s.* 0*d.*, to Fellows, 18*s.* 0*d.*

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1932–3.—Vols. 1–2, £1 16*s.* 0*d.*; to Fellows, £1 7*s.* 0*d.*

1934.—Vol. 3, subscription rate £1 4*s.* 0*d.*, to Fellows, 16*s.* 0*d.*; monthly parts 3*s.* 0*d.* each, to Fellows, 2*s.* 0*d.*

Wednesday, 4th April, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

Exhibits.

The following communications were made to the meeting :—

The Bed-bug. By A. W. McKenny Hughes.

The Hon. Secretary exhibited a short film which had been taken in the slums of London to explore the possibility of producing a film of the Bed-bug for propaganda purposes. The results encouraged one to believe that, given improvement of technique, such a film is possible.

He then dealt with some aspects of the Bed-bug problem. The moving of tenants from infested slum areas to new housing estates provides no practical difficulties. The furniture can be fumigated in transit, in pantechnicons, by means of hydrocyanic acid gas, thus ensuring that it is free from Bed-bugs on arrival at the new house. In certain schemes the tenants themselves are taken to a disinfecting station, where they have baths and their clothes are fumigated. On the other side of the picture we find houses which are infested but not scheduled as a clearance area and from which there is no chance of moving the tenants; these areas are many and widely distributed throughout the country. Many large districts in London and the provinces are little short of 100 per cent. infested. Many remedies have been suggested for dealing with infestations in houses—sulphur, sprays and the like, but none of them can claim complete efficiency. Up to the present time the danger of using hydrocyanic acid gas in crowded areas, and the time necessary to complete the fumigation of a house by the ordinary method, have proved insuperable barriers to the common use of this fumigant, though no one doubts its efficiency. A new technique for the use of hydrocyanic acid gas has been evolved and is at present being tested—namely the use of a hot-air blower before and after treatment. If this method is successful, the whole operation of clearing a house should be accomplished in eight hours as opposed to the usual twenty-four, and if carried out by experts, should be possible without risk. Various other insecticides known to be toxic to Bed-bugs are being experimented with, but so far none of them has been entirely successful.

The Hon. Secretary emphasised the need for education and for a cleanliness campaign. He pointed out that regular inspection by nurse-inspectors had proved extremely successful in certain parts of the country, and that the tenants themselves had been taught to recognise the different stages of the insect, and to eliminate them by the use of scrubbing brush, hot water, soap and soda. He suggested that if a large scheme of fumigation was under consideration it was essential to run a cleanliness campaign concurrently, since it is useless to expend large sums on the eradication of Bed-bugs if the chances of reinfestation are not reduced to a minimum. Education of the tenants in the habit of cleanliness, in the dangers attendant on the purchase of secondhand furniture, in the recognition of the early stages of the bug and of signs of infestation, are all essential, if this pest is to be exterminated. Cleanliness must be the foundation on which all schemes are built.

Some Histological Changes during Moulting. By Dr. V. B. Wigglesworth.

Some of the changes that occur during moulting in *Rhodnius prolixus* (Hemiptera) were described. Only one meal of blood is needed by this insect in each stage; moulting takes place at a definite interval after each feed. The epidermal cells first separate from the cuticle and multiply rapidly by mitotic division. When this process is at an end, they lay down the non-chitinous *epicuticle*, composed of the material called " cuticulin," and then secrete below this the *endocuticle*, composed of a mixture of protein and chitin. The inner third of the endocuticle is not developed until after moulting. The bristles are formed by trichogen cells; these give out processes, which pass through annular " tormogen " or socket-forming cells, and later become chitinised and impregnated with cuticulin. Meanwhile the moulting glands pour out the moulting fluid which fills the space between the new cuticle and the old. This fluid appears to contain digestive enzymes, a protease and a chitinase, which dissolve the old endocuticle; the products of digestion being absorbed through the general surface of the insect, and presumably used again in the formation of the new cuticle. In this way, nearly 90 per cent. of the substance of the abdominal cuticle may be reabsorbed before the old skin is cast. The moulting fluid attacks only the endocuticle; when the insect moults it sheds little more than the epicuticle, upon which the fluid has no action.

A full account of these observations is published in 1933, *Quart. J. micr. Sci.*, **76 :** 269–318.

Papers.

The following papers were read :

(1) " The male and female genitalia and the biology of *Euchalcidia caryobori* Hanna," by A. D. Hanna.

(2) " New Exotic Hydroptilidae," by M. E. Mosely.

(3) " Spiral and other anomalous forms of segmentation with an account of three ventral spirals in one brood of *Hadena dissimilis* Kn.," by E. A. Cockayne.

(4) " On some further remarkable structures in Trichoptera," by H. Eltringham.

(5) " Übersicht der orientalischen Gattungen und Arten des *Carcelia*-Komplexes. (Diptera—Tachinidae)," by N. Baranov.

Wednesday, 2nd May, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

Election of Fellow.

The following was elected a Fellow of the Society :—

Leonard G. Hulls, Rax, Chidham, Near Chichester, Sussex.

Obituary.

The death of Mr. J. B. Hicks, a Fellow of the Society, was announced.

Exhibits.

The following communications were then made to the meeting :—

REPLIES TO DR. W. L. MCATEE'S REJOINDER IN PROC. ROY. ENT. SOC. LOND., 8 : 113–126, TO PAPERS ON PROTECTIVE ADAPTATIONS PUBLISHED BY THE SOCIETY (*loc. cit.* 7 : 79–105).

The replies follow the order adopted by Dr. McAtee. The statements of authors unable to be present were communicated by Prof. Poulton.

Dr. McAtee and "Relative Acceptability" (8 : 113–116).

Dr. FRANK MORTON JONES, who was unable to be present, sent the following reply :—

In criticism of my recent paper (*Trans. ent. Soc. Lond.*, **80** : 345–385) on "Relative acceptability of insects to birds," Dr. W. L. McAtee (*Proc. Roy. ent. Soc. Lond.*, **8** : 113–116) says, "As a matter of fact none of the 8 species which Dr. Jones lists as contributing most to his records is a preponderantly insectivorous species." This statement, with its intended implication that the food-habits of these eight bird species detract from the significance of the experiments, gives an erroneous impression of fact, even as presented by Dr. McAtee and his associates of the Biological Survey. Dr. McAtee himself (in "The Relation of Birds to Woodlots," 1926) stresses the economic value of most of these birds as destroyers of injurious insects, and in his enumeration of the percentages of animal matter (chiefly insects) in their food, credits the Brown Thrasher (p. 82) with 64 per cent. animal food; the Catbird (p. 78) with 44 per cent.; the Robin (p. 93) with 40 per cent.; the Song Sparrow (p. 62) with 33 per cent.; the Chewink (p. 64) with 30 per cent.; and he even permits himself to speak with enthusiasm (p. 50) of the Blue Jay as a notable destroyer of injurious insects.

From other publications for which Dr. McAtee's associates in the Biological Survey have been responsible and of which he is fully aware, it is apparent that in the summer season the percentages of animal (insect) food of some of the eight bird species are materially greater than those just enumerated. For example :—

Song Sparrow, 1901, Bull. U.S. biol. Surv. **15** : 84—"Insects . . . from May to August, inclusive, when they are eaten most freely, compose more than half the food."

Grackle, 1900, Bull. U.S. biol. Surv. **13** : 60—"Insect food . . . steadily increases till May, when it reaches its maximum of five-eighths of the whole." Further tabulations in the same publication indicate that more than 50 per cent. insect food is eaten in May and June, over 40 per cent. in July.

Brown Thrasher, 1913, Frmrs'. Bull. **513** : 11—". . . insects, which constitute more than 60 per cent. of its food."

Cowbird, 1900, Bull. U.S. biol. Surv. **13** : 24–25—". . . the animal food consists almost entirely of insects and spiders." Tabulations follow, showing insect food to constitute nearly 60 per cent. for June, over 50 per cent. for July and August.

That is, several if not all of the eight bird species utilised in my experiments *are* predominantly insectivorous *at the season of experiment* ("mid-June to early September"), and in this connection the statement of their habits to the contrary could not have been more misleading had it been literally and entirely untrue.

Though we are told by Dr. McAtee that none of these birds feed upon adult Lepidoptera to "as much as 2 per cent. of their total diet" (at what season?), yet

he omits Lepidoptera from further consideration for the added reason that in the Survey's records of stomach contents, " identification of these insects to species is so seldom carried out." In the experiments these birds showed themselves just as ready to accept moths as beetles, and just as consistent in their refusals of a large percentage of the more gaudily coloured insects of both groups, in contrast with their ready acceptance of those of duller colours.

Dr. McAtee states that " selection of food items in experiments always is to some degree that of the experimenter." In my experiments, selection of food available *was* that of the experimenter; but the choice from this, of items for refusal, *was the selection of the birds*; and that selection, consistently repeated many times over, was the more significant for the fact that it was made from an abundant and varied supply of other items which were readily accepted.

Dr. McAtee compares my table of insects used in experiments (my pp. 381–385) with the Biological Survey records of these same insects as identified in the stomachs of Nearctic birds. Whatever may be the significance of his figures, based upon " times identified " in the stomachs of *all* Nearctic birds, they offer no evidence against the phenomena I record in the behaviour of eight species of birds. On his own basis, his results would have been very different, had he not omitted two items (*Phyllophaga* and *Polyphylla* [p. 382], *Cantharis* sp. [p. 384]) from his tabulations of Sections I and II, while including three similar items (*Chrysopa* sp., *Ophion* sp. and related, *Bombus* sp. [p. 385],—identifications to genera, not to species) in Section III.

How completely deceptive is any attempt to compare figures on his basis and mine (mine based on numbers of insects used, his on numbers of times identified) may be illustrated by an example from his tabulations, where a single species, *Harpalus caliginosus* Fab., is credited with nearly forty per cent. of the total number of units for Section III; for *if every one of the eighty thousand stomachs* studied by the Biological Survey had contained this insect, that fact would not have invalidated the conclusions based upon my experiments; for not in anticipation of any such use of these tables but as a statement of obvious fact, in my 1932 paper (p. 353) I pointed out that this and four other species were each used only once—single insects among five thousand others—hence stating that their " low rating may well be purely accidental." In this light, Dr. McAtee's tabulations of Section III lose their assigned significance.

In recognition of this fact, that the significance of the assigned rating of any given species hinges upon its use, in competition with other fairly comparable insects, in sufficient numbers and frequency to eliminate or reduce the element of chance, I gave separate consideration (pp. 357–363) to a number of insects whose records seemed to meet that requirement. If Dr. McAtee will compare the eight beetles with his own tabulations, he will find that by his figures their record per species is not 26·76, but 2·25.

With final reference to Dr. McAtee's tabulations, these are based upon my pages 381–385, where I enumerate all the insects of all orders, used in my experiments; but *these are not the tabulations* from which I deduced the influence of coloration on relative acceptability. On an early page (346) of my paper I stated that in so far as it should prove possible it was my endeavour that " each included species should be in competition with some others of like size and general character,

and of proven acceptability." Following that principle, on pages 350 and 352 I brought together for comparison in tabular form *all the moths* and *all the beetles* (including only two insects of other orders), a total of more than four thousand insects of nearly two hundred species, and from that tabulation presented evidence of the influence of coloration on relative acceptability. That is, I intentionally excluded from the tabulation Neuroptera and Hymenoptera, which in every experiment showed themselves relatively unacceptable to these birds, with (for many of them) coloration not the deciding factor.

Dr. McAtee asks, "Why experiment?" Stomach examinations show what a bird has eaten, and may show in what quantities eaten; but they do not show from what insect population that selection was made. On a feeding-tray, a known insect population is sorted out by the bird in accordance with its preferences, refusals are not determined by numbers or availability, and the basis of these refusals is sometimes and in some degree determinable.

As Dr. McAtee points out, experiments usually do include some departure from natural conditions; but as he himself has said (1932, *Smithson. miscel. Coll.* **85** (7): 140), "The experience we have when we place inviting food supplies in abundance before the birds indicates what must happen in nature under similar circumstances."

Rejoinder (Proc. 8 : 116, 117) to Prof. E. B. Poulton (Proc. 7 : 80–86).

Prof. POULTON communicated the following reply:—

In his rejoinder to my contribution (**7** : 80–86) to the discussion of 7 December, 1932, Dr. McAtee alters the material of the bags enclosing the caterpillars from "muslin" to "cloth," and thus having transformed a considerable measure of visibility into complete invisibility, proceeds to base the following adverse conclusion on this fictitious quality:—"If the birds pecked into some and devoured the contents and ignored others, it would appear that some quality other than colour gives the 'protection' and that unusual coloration would therefore be unnecessary to their defence" (p. 116).

Of course the protection is given by "some quality other than colour"—in the *grossulariata* larvae by distastefulness to insect-eaters, as has been proved again and again. The conspicuous pattern, warning of this distastefulness, would certainly be visible through the coarse muslin to the sharp eyes of a bird. Furthermore, the number of larvae thus compelled to be gregarious would probably advertise their unpalatability to an enemy with a highly developed sense of smell. The fact that procryptic caterpillars were detected and devoured wholesale by birds and wasps while conspicuous ones, kept in the same kind of bag in the same garden, were neglected will not be ignored as seeming "of little value in this field," by an unbiased naturalist.

The words "How different would be the fate of procryptically coloured insects crowded in a small area——" referred to the gregarious habits of the conspicuous black and red Burnet moths (p. 81) and would be equally applicable to the companies of Buff-tip caterpillars mentioned on the following page. To this McAtee replies that certain insects which he considers to be procryptic *are* gregarious, giving such instances as "grey Psocids in patches on tree-trunks" or "swarms of Chironomids" and "winter-crane-flies" on the wing—instances which are in

no way comparable with Burnet moths "often crowded in a corner of a field or common—conspicuous in flight or at rest," or the "Buff-tip caterpillars advertising their presence by the conspicuousness of their massed colours, and also by the expanse of leafless twigs around them." The gregarious habits associated with courtship or with other epigamic or social behaviour are well known and are very different from the aposematic display of the Burnet moths and countless other examples. Of much interest in this connection are the relatively rare examples of a cryptic effect brought about by clustering.*

As regards the stick-like Geometrid larvae it is convenient to recall McAtee's original criticism † of my statement ‡ and that made by P. G. Howes.§ The *specialised stick-like larvae* of GEOMETRIDAE, and these alone, are referred to in our words quoted by Dr. McAtee when he replied that "such a defense depends upon immobility whereas these caterpillars must be in motion the greater part of the time while searching for and devouring food" (p. 58). Confronted by the statement that these caterpillars move about to feed at night and are enabled by various adaptations to remain still and rigid by day (*Proc.* **7** : 84–6), he shifts his ground to Geometrid larvae generally and especially mentions the "cankerworms" which are not of the stick-like type and appear to resemble our British species of *Hybernia*.‖ I have had a long and wide experience of our stick-like Geometrid larvae, and all I have bred or observed in the field have been—unless disturbed or subjected to unnatural conditions such as overcrowding—invariably rigid and motionless during the daylight hours. There are occasional failures in the adaptation, although I do not remember one ; but my friend Miss Balfour, who has keenly observed caterpillars for many years, informs me that "the stick-like larvae sometimes turn the wrong way, and then of course betray themselves at once. I have several times found them in this reversed position." Such a failure as this is, of course, very much less than the complete abandonment of rigidity which Mr. J. R. Malloch ¶ believes he has often observed. The "selectionist," so much despised by McAtee, will conclude that any such partial or extreme failures of instinct are prevented from rising to dangerous proportions by the operation of the Darwin–Wallace principle.

Although, as stated above, I was not referring to the "cankerworms" or to any except the highly specialised stick-like Geometrid larvae, the following statement in a letter from my friend our Hon. Fellow, Dr. L. O. Howard, is of so much interest in relation to the attacks of birds upon insects that I am sure the Society will be glad to have the opportunity of reading it :—

* The African homopteron *Flata nigrocincta* Walk. is an interesting example illustrated in the late Prof. J. W. Gregory's "Great Rift Valley," Lond., 1896, and later by S. L. Hinde in *Trans. ent. Soc. Lond.*, **1902** : 695, pls. xxvi, xxvii; also possibly the caterpillars mentioned in 1932–33 *Proc.*, **7** : 47 and footnote.

† "Effectiveness in nature of the so-called protective adaptations in the animal kingdom, etc.," 1932, *Smithson. miscel. Coll.*, **85**, (7) : 53, 58 (quoted as "85" on p. 53).

‡ "Colours of Animals," Lond., 1890, p. 26.

§ "Insect behavior," 1919, pp. 164, 165.

‖ This conclusion is suggested by the description and figures of "The Spring" and "The Fall Canker-worm" in W. J. Holland's "Moth book," N.Y., 1903 : 324, 326, pl. xlii, figs. 25, 26.

¶ In the courteous letter by which Mr. Malloch replied to my inquiries, he wrote :—"I was not thinking of the stick-like forms only and I rather fear that there is such a gradual gradation from such types in their more marked forms to those of much less stick-like type that any general rule cannot be applied to them." But it was only to the "more marked forms" that I referred.

11 *Jan.*, 1934.—" You may be interested to know that back in the 1860's and early 1870's cankerworms were a real pest in most of our northern cities and villages, and also to a much lesser extent in the orchards. I remember as a boy very well that they were active in the daytime on the shade-trees in Ithaca, N.Y., and that they were constantly spinning down to such an extent that passers-by nearly always had to brush them from their clothing before entering houses.

" So much for their daytime activity. Now as to birds: The English sparrow was brought over to this country largely to destroy the cankerworms, and as it increased and spread it did destroy them. They are no longer considered a pest and have not so been considered for many years, and I attribute this practically entirely to the English sparrow. *But*, after a number of years, the so-called white-marked tussock moth (*Orgyia leucostigma* F.) accommodated itself to urban life and became from time to time a serious shade-tree pest. The larva of this species, being very hairy, was not eaten by the English sparrow; and the birds that would eat it, namely the vireos and their relatives, were speedily driven from our towns and cities by the English sparrow. I have reviewed this briefly in a bulletin entitled ' A Study in Insect Parasitism.' " *

Dr. McAtee, on p. 116, quotes two short sentences from a very interesting paper by R. T. Young.† As the first of these sentences treats of the essential importance of stillness in protective resemblance and the second, taken by itself, gives a wholly false impression, I have reproduced below the author's statement, on p. 498, of his conclusions based on *the whole* of the evidence :—

He describes " The purpose of the experiments [as] being . . . to ascertain whether or not protective resemblance in the case of motionless animals is really an efficient means of protection to them.

" This latter question has I believe been answered in the affirmative by these experiments. I have endeavoured in them to put to an experimental test a hitherto practically untested hypothesis."

The author is mistaken in this last sentence, for the researches conducted in 1898 and referred to by Mrs. C. B. S. Hodson (*Proc.*, **7 : 90**) were devised and carried out in order to provide such an experimental test (see p. 28).

R. T. Young's " Final Summary," printed on p. 499, is as follows :—

" 1. Protective resemblance is effective in protecting motionless animals from attacks by caged birds.

" 2. Stillness is probably a more important factor than color in protecting animals from their foes."

I entirely agree with the general truth of this last opinion. All the various co-ordinated elements of function and structure which combine to produce the cryptic resemblance of a specialised stick-like Geometrid larva would be useless without stillness, and I believe that any naturalist who will make a special study of *these* caterpillars will find, as I have done, that their behaviour is not such as to destroy the whole meaning and value of the cryptic resemblance, and especially of those very contrivances by which a prolonged rigidity may be maintained.

* 1897, *Bull. U.S. Div. Ent.* (*Tech. Ser.*), **5**.
† " Some Experiments on Protective Coloration," 1916, *J. exp. Zool.* **20 : 457–499.**

Rejoinder (8 : 117–119) to Prof. R. A. Fisher (7 : 87–89).

Prof. R. A. Fisher, F.R.S., who was unable to be present, sent the following reply :—

In commenting on McAtee's criticism of the theory of protective adaptations, at a meeting of the Entomological Society, it appeared to me that a major cause for disagreement lay in that author's conviction, which he had evidently cherished for many years, that his tabulations of species identified in birds' stomachs had an important, and even a conclusive, bearing on the theory he was discussing. This belief seemed to me to rest on a logical fallacy, which could be recognised by stating what observable facts the theory really implies, and by noticing that these had no point of contact with the facts reported by McAtee.

In his reply McAtee appears at first to admit that the criticism was well directed. He asks the disarming question, " The treatment of the subject has been highly speculative, so why blame McAtee for throwing no light upon the question ? " I should explain, therefore, that I did not criticise McAtee for throwing no light upon the question, but for putting forward a large mass of irrelevant data, and for stressing in the strongest terms its supposedly decisive value.

Again, I noted the abundant use of the saving words " approximately," " practically," and the like, not that they seemed inappropriate to the vague statements which they qualified, but because statements, requiring such qualification at every point, are inadequate to establish the quantitative conclusion which McAtee claimed to have established; namely, that the evidence he had to offer showed that predatism was determined by abundance to *such an extent* as to exclude selective feeding habits. Dr. McAtee explains that he has been taught, and continues to believe, that employment of such saving words is the mark of a scientist. I shall merely suggest, therefore, that when he uses them the scientist should also appreciate the limitations that they exist to convey.

On the question " *How* largely predators must be guided in the choice of food by availability, so as practically to ignore protective adaptations," McAtee repeats that the degree to which they were shown, in his Smithsonian paper, to ignore protective adaptations, creates a presumption of indiscriminate tendencies. Here the cart is put before the horse. The Smithsonian paper claimed to show that availability was so important that protective adaptations could not be effective. The paper only showed that abundance was an important factor. From this fact the illegitimate inference was drawn that other factors must be unimportant. The paper did not pretend to supply any direct measure of the importance of protective adaptations, and it is only researches directed to this end that can have any logical force.

Finally, it may be worth while to comment on the statement that " selection " merely means death before reproduction. This embodies a fallacy far more widely held than the others we have been discussing. Selection embraces every factor which causes one type of individual to be more largely represented than another in future generations. It includes differential mortality before and during the reproductive period. In plants it includes partial death, or the dying back of

parts, and also the differential growth by which one plant may become larger than another. It includes differential fertility during the reproductive period, which in man and the domestic animals is known to be a very important factor indeed. It includes resistance to debilitating diseases, over and above their effect on the death-rate if they adversely affect reproduction, or, for example, lactation in mammals. In the case of the social insects the factors which influence the representation of the germ-plasm in future generations must often be still more indirect.

Rejoinder (8 : 119, 120) to Sir Guy Marshall (7 : 89, 90).

Prof. POULTON communicated the following brief reply to Dr. McAtee's criticisms. His friend Sir Guy Marshall, who was unable to be present, had seen the manuscript and had expressed his agreement.

Dr. McAtee, in his reply, implies that Sir Guy Marshall had maintained that ant mimicry does not exist in the Nearctic Region. This is an incorrect interpretation of the statement :—" ant mimicry finds its highest development in the tropics, where ants are a dominating feature of insect life, but it is a comparatively rare phenomenon in the North Temperate Zone . . ." (p. 89). He then quotes Sir Guy Marshall's sentence on page 90 :—" McAtee tacitly assumes that all ants are supposed to be protected from attack, an assumption that is entirely without warrant "—and continues that he " is really glad to have this admission but wonders whether the other selectionists will abide by it "—an entirely unnecessary and baseless doubt.

Dr. McAtee then attempts to justify his assumption by quoting words of mine which conclude with the statement that certain species of insect-eating animals " are adapted to feed almost exclusively upon " ants.* McAtee does not appear to realise that he is bringing forward the obvious disproof of his own assertion as the evidence in favour of it.

As regards the later paragraphs of Dr. McAtee's rejoinder, I may refer to my paper " Ants as models for mimicry " † in which it is shown that it is unsound to argue " because ants have many enemies [therefore] the resemblance to ants cannot protect against enemies."

Rejoinder (8 : 121) to Mr. H. St. J. K. Donisthorpe (7 : 90).

Mr. DONISTHORPE, who was unable to be present, sent the following reply :—

Dr. McAtee quotes or rather misquotes me as saying that I had " no evidence of birds capturing worker ants." My words were :—" Personally I have never seen a bird in this country capture worker ants in the field, though I have seen the long funnel-shaped holes in the nests of *Formica rufa*, L., made by the green woodpecker to get at the ants in winter " (*Proc.* **7** : 90). This sentence supplies

* From an address to the Fifth Internat. Zool. Congr., Berlin, 15 Aug., 1901 (*Verh. Int. zool. Congr. Berlin*, 5, 1902, p. 171).
It seems worth while to quote the following sentence from *Trans. ent. Soc. Lond.*, **1903** : 573 :—
" All animals with warning colours have enemies, all are liable to special attacks, in times of exceptional hunger, by enemies which would at other times neglect them."

† 1929 (Wasmann-Festband), *Zool. Anz.* **82** : 79–86.

circumstantial evidence of attacks on the workers. Furthermore, the statement "that worker ants are in general well protected" obviously implies that their protection may fail, although, as may be inferred from my remarks, to nothing like the same extent as that of the winged forms.

Shortly after the meeting of June 6 Prof. Poulton received a courteous letter from Dr. Walter E. Collinge informing him that the twenty-two species of British birds, recorded on his authority as "ant-eating" by Dr. McAtee (p. 121), were given in answer to a request for "a list of birds in whose stomachs" he had found ants. In sending the list Dr. Collinge had stated that "the species which eat the largest percentages are the Woodpeckers and Partridges." Dr. Collinge had now kindly given Prof. Poulton the names of those birds out of the twenty-two which he looked upon as ant enemies :—

"The frequent occurrence of ants in varying percentages in the ten following species leads me to regard them as ant enemies :—corn-bunting, sky-lark, robin, hoopoe, all three woodpeckers, partridge, red-legged partridge and grouse. These species show a distinct preference for ants, the remaining twelve eat them only occasionally." Dr. Collinge furthermore distinguishes between the first three birds and the others :—"The corn-bunting, sky-lark and robin evidently show a preference for ants, but the occasions when they occur in the stomachs are comparatively few, although the percentage is high. I should say they are not regular enemies like the woodpeckers, partridges and grouse, but when they meet with ants in large numbers they evidently show a preference for these insects."

Dr. Collinge had also sent the following more detailed information concerning the seven species which he regards as regular enemies of ants :—

"*Hoopoe*—the few specimens examined have contained large numbers of both workers and winged forms.

"*The three woodpeckers*—eat ants all the year round in my experience—workers mostly, but winged forms also.

"*The two partridges and grouse*—eat ants, April to October,—workers mostly, but winged forms also."

The above interesting and valuable information affords a good example of the conclusions which may be drawn when a subject is approached in the spirit of the naturalist rather than by Dr. McAtee's mechanical and unscientific method of lumping all records, large or small, regardless of their widely varying significance.—E. B. P.

Rejoinder (8 : 121) to Mrs. C. B. S. Hodson (7 : 90).

Prof. Poulton replied on behalf of his friend Mrs. Hodson who was unable to be present but had expressed her entire agreement with the following brief statement :—

Dr. McAtee, referring to the conclusions "that sight is important to enemies in discovering the pupae [of *Aglais urticae* L.], and that conspicuously exposed specimens were most freely preyed upon," maintains that they "offer nothing that is opposed to the arguments" of his paper. The opposition was to his confident assertions rather than arguments—such assertions as those made concerning

the leaping Orthoptera :—" Despite persecution, these insects abound and the reasons are high fecundity and the great surplus of food available to them; these are substantial realities and outweigh immeasurably those airy intangibilities classed as protective adaptations." * If the protective adaptations of the pupae were proved to be advantageous, as McAtee appears to admit, why should the same methods count for nothing in the life of a grasshopper?

Rejoinder (8 : 121–123) to Mrs. M. D. Brindley (7 : 91–94).

Mrs. Brindley communicated the following reply :—

Dr. McAtee's reply to my criticisms consists for the most part of generalities on which it is difficult to comment.

p. 121.

Paragraph 2. I am still not convinced that the number of species in a group is necessarily a fair index (or in many cases even a rough one) of the absolute abundance of individuals. In this connection, attention might be drawn to some results of insect trapping in the U.S.A., published in a paper by Samuel S. Graham on " The Influence of Civilisation on the Insect Fauna of Forests in North America " (1933, *Ann. ent. Soc. Amer.*, **26** : 497–528). However, if Dr. McAtee thinks that the assumption helps the case, I am ready to agree that perhaps there may be more individual soil Protozoa, Nematodes and even Chironomids on the globe than there are ants.

p. 122.

Paragraph 1 contains another attempt to smother us with those " thousand type-written sheets "; and the writer goes on to declare that if he could assemble data on 800,000 stomachs, the " showing for indiscriminacy of predation would certainly be greatly increased."

What matters here is not the number of sheets but the form in which the facts are presented on them; and if the additional data were set out like those already under review, it is doubtful if they would be of much more assistance to the unprejudiced reader than those already offered. Paragraph 2 on p. 122 is an example. Here Dr. McAtee protests that insufficient credit is given to the powers of field observation of his assistants in the U.S. Biological Survey. But as it was a loose generalisation of his own that " birds habitually devour the excreta of their young " that called forth criticism, he can hardly object if his readers supposed that he, or those from whom he derived his information, were insufficiently acquainted with the nesting habits of birds. Similarly it was not " uncalled-for " to remark that analyses of stomach contents would be misleading unless samples were taken regularly from the same area throughout the year. It would certainly be an elementary precaution to take; but there is nothing in the presentation of the data to show that it was taken, and after all we can only judge of the facts as they are presented to us.

Paragraph 3. Here I must plead guilty to some loose writing myself. What I meant, and ought to have made clear, when discussing the food of the Song Thrush, was that this species is the only bird known *habitually* to take *Helix nemor-*

* W. L. McAtee, 1932, *Smithson. miscel. Coll.*, **85** (7) : 38.

alis and *H. aspersa*, as part of the regular food. The other birds mentioned take them only exceptionally, as Dr. Collinge's published analyses of stomach contents clearly show, though Dr. McAtee writes as though they fed as regularly on these snails as the Song Thrush does.

Paragraph 4. Dr. McAtee's further remarks on *Pogonomyrmex* seem beside the point. Granted that this genus is found only in a restricted area of the country—that did not prevent Dr. McAtee from citing the case triumphantly as further proof of the truth of his views. Whether it really is so, is not so certain. We learned from the original paper that there were 66 records of these ants from the stomachs of 25 species of birds. I adhere to what I said before, that the only inference that can be reasonably drawn from the figures supplied is that though various birds were ready to experiment with *Pogonomyrmex* as food, they were not very satisfied with the results of their experiment, when, as far as averages go (though really they have little or no meaning when worked out on these figures) we find that each species has only 2·6 records of the harvester ant to its credit. Now Dr. McAtee tells us that further analyses show 90 records from 29 species, and he adds "and so it goes with food habit studies." But how far is it going?

I cannot see how 90 records distributed over 29 species of birds support the theory of indiscriminate predation when 18 of the records—that is one-fifth—refer to a single species, namely Gambel's Quail. At first sight this high proportion suggests a parallel to the case of the Wheatear and *Bombus* to which I drew attention before. Is this Quail a species that has become adapted to eat with indifference or even relish insects that are repugnant to most birds? Let us suppose for a moment that this is the case, and set its records aside. Then we find that *Pogonomyrmex* was taken 72 times by 28 species, that is to say 2·5 records per species. Why does Dr. McAtee think that these figures help his case better than those given in his Smithsonian Paper? I repeat, it looks very much as if a number of bird species experimented with the harvester ant as food and rather disliked it, but that one species was so far adapted as to take it more freely. To support the theory of indiscriminate predation surely the records should be distributed more evenly over the 29 species to which they can be referred. But this is not all. Let us examine a little more closely the figures for Gambel's Quail itself, for they are instructive. We find that 84 stomachs were examined; but of these, only 18—that is, rather less than a quarter—contained the ant. Of these 18, one or some—characteristically we are not told exactly how many—were represented by a single ant, and the rest by numbers, again unspecified, up to 23.

All this simply means that neither Dr. McAtee nor anyone else, not merely from the data available, but from the data humanly procurable, can possibly determine whether this incidence of *Pogonomyrmex* in 84 individuals of Gambel's Quail is due to indiscriminate predation conditioned by the number and the availability of the prey; or by the taste of the predator, conditioned by its hunger, by its seasonal presence in the feeding area, and probably by other factors such as time relations in the killing of individuals for examination. The figures will fit either view, and express what they are desired to express.

"So it goes with food habit studies." And so it goes with the figures of Dr. McAtee. They really leave us very much where we were before.

Rejoinder (8 : 123) to Mr. Hugh B. Cott (7 : 94–96).

Mr. Cott communicated the following reply :—

In an earlier communication (1) I criticised the manner in which Dr. McAtee presented his data, namely in terms of the birds' stomachs containing different types of prey, rather than of the relative numbers of prey eaten—the figures which we essentially require in considering the efficiency of protective adaptations. Dr. McAtee counters my argument by pleading misrepresentation :—" This writer here as elsewhere shows a tendency to read his own meaning into my words and then criticise it." It is unfortunate that Dr. McAtee reserves a special meaning for words which he uses, and then takes exception when I point out that in speaking of the " number of captures " what he really means is the number of stomachs from which captures were taken.

Attention was also drawn above (1) to the fallacy of Dr. McAtee's central argument, which I now quote verbatim from his summary (2, p. 144). " The combined attack of birds plus all other predators still more closely approaches complete indiscriminacy. In other words there is a utilization of animals of practically every kind for food approximately in proportion to their numbers. This means that predation takes place much the same as if there were no such thing as protective adaptations. And this is only another way of saying that the phenomena classed by theorists as protective adaptations have little or no effectiveness." With these words Dr. McAtee dismisses the effectiveness of such adaptations as stings, spines, stinking or poisonous secretions, concealing coloration, warning colours and mimicry. This is like arguing that because during war certain infantry units suffer casualties approximately in proportion to their numerical strength, this means that casualties occur much the same as if there were no such thing as defence. And this is only another way of saying that the phenomena classed by theorists as bayonets, barbed-wire entanglements, poison gas, camouflage and strategy have little or no effectiveness.

Proportional predation by a group is a very different thing from indiscriminate predation by individual animals. Predation by one enemy on a " protected " species does not prove, as Dr. McAtee seems to imagine, that protective devices are ineffective against other enemies. It has been said that in America the automobile is the chief enemy of the toad. Now the automobile is " indiscriminate " in its attacks upon small animals; it is unaffected by the toads' poison; it accounts for thousands of victims annually, especially during the spawning migrations. But must we believe that because a large proportion of adult toads are killed by automobiles, the protective adaptations of these animals, *i.e.* their poisonous secretions, " have little or no effectiveness " against other potential enemies ?

What is the available evidence relating to the efficiency of the toads' secretions as a defence against enemies ? In Great Britain we have two species of toad (*Bufo bufo* and *B. calamita*) and one indigenous frog (*Rana temporaria*). If the number of species be taken as an indication of the numbers of individuals available (Dr. McAtee's standard (2, p. 7)), one might expect to find (according to Dr. McAtee's theory of proportional predation) approximately twice as many birds preying upon toads as upon frogs. Now the actual figures are interesting.

61 species of British birds prey upon frogs (RANIDAE); *
9 species of British birds prey upon toads (BUFONIDAE).

Anybody, except Dr. McAtee, would regard these figures as evidence that toads, as compared with frogs, are relatively unpalatable. Let us now consider Dr. McAtee's figures under this head (2, p. 121).

535 identifications of RANIDAE; Nearctic species, 22; †
60 identifications of BUFONIDAE; Nearctic species, 18.

His comments on these figures are illuminating :—" Clearly the RANIDAE or frogs are more preyed upon than any other group, certainly much more so than the toads. The theorist on adaptations attributes this to the superior special defenses of toads, but with no doubt whatever the difference in amount of predation on these two groups is a direct reflection of their relative abundance." In making this statement, Dr. McAtee conveniently ignores his own standard for estimating the relative abundance of individuals by reference to the number of species in the groups concerned. He gives us no reason for doing so, nor does he give any figures to support the present dogmatic assertion of proportional predation, which here, as usual, is cited as pointing to the inefficiency of protective adaptations in averting the attacks of foes.

Another fallacy of Dr. McAtee's is the assumption that a protected species should increase in numbers. He continues with reference to the toads as follows :—" If toads really were specially protected, if their so-called defenses saved them from a certain proportion of predatory attacks, should they not increase continually relative to the RANIDAE? The fact that they do not is the best proof that could be asked that their 'special defenses' do not actually function in nature." This is a remarkable statement from one who claims to speak with authority on protective adaptations, and yet makes the elementary mistake of inferring that predatory attack is the only effective check upon increase in numbers. It ignores the fact that animal numbers are controlled by many factors besides predation, among which may be mentioned parasites, climate, food supply, breeding sites, fecundity and longevity. Dr. McAtee here overlooks the fact that there are in every part of the habitable world animals with no predatory enemies whatever. The organisation of animal communities into complex systems of food chains ensures that certain dominant predators at the end of the chains have, normally, nothing to fear from predation. Examples of such terminal animals are the giant toad *Bufo marinus* in South America, and the Gannet and Golden Eagle in this country.

In replying to figures which I brought forward (1, p. 96) as evidence of discrimination in frogs, Dr. McAtee now states (3, p. 123) that he " never said or implied that predation by single species is in proportion to population." Yet his main argument against the effectiveness of protective adaptations depends upon the theory of proportional predation, which, he claims, " denotes indiscrimination, the very antithesis of selection " (2, p. 144).

Discrimination, or its opposite, can best be studied in reference to the food-

* Computed from Witherby, " A Practical Handbook of British Birds."
† Computed from Stejneger and Barbour, 1923, " Check list of North American Amphibians and Reptiles."

habits of individual species severally. When the food of single species is examined quantitatively, selection is found to occur not only in those higher groups, the birds and mammals, but in more lowly vertebrates such as the Anura. The following figures, which show the number of typically aposematic ("AA") food-animals included in the diet of certain East African and Canarian tree frogs examined by the writer, may be cited as evidence of discrimination and avoidance of unpalatable prey :—

Species.	Total prey.*	Aposematic Prey.	Per cent.
Hyperolius marmoratus . . .	2648	0	0·00
Hyperolius bayoni . . .	3641	1	0·03
Hyperolius argus	3249	4	0·12
Megalixalus fornasinii . . .	829	9	1·09
Megalixalus brachycnemis . .	31	0	0·00
Leptopelis johnstoni . . .	6	0	0·00
Phrynobatrachus acridoides . .	564	0	0·00
Hyla arborea var. *meridionalis* .	617	6	0·97

* Total number of prey classified in reference to colour. (6, Tables XII, XIII).

The following further evidence of differential food preference in the case of British Anura is based upon the identification of prey from the stomachs of *Bufo bufo* and *Rana temporaria* :—

4344 Hymenoptera recovered from *Bufo bufo* included only one bumble bee (*Bombus*) and three wasps (*Vespa*).

47 Hymenoptera recovered from *Rana temporaria* included a single bee and no wasps.

Last summer I carried out experiments to determine whether hive bees are acceptable or distasteful to toads, and to discover—if they proved distasteful—how quickly the toads learn to recognise and avoid these insects, and whether the lesson of avoidance, once learned, is remembered. An extract from a letter on this subject to Professor Poulton has been quoted elsewhere (4, p. 158). While it is hoped to publish shortly a full account of these experiments, it will not be inappropriate to add here a few facts bearing upon the question of protective adaptations of prey, and discrimination by predators.

The toads used were wild adults of *Bufo bufo*, which were kept for some weeks after capture in a roomy vivarium, where they fed well upon a variety of insects, notably mealworms, and cockroaches. Toads undergoing test were placed, one at a time, upon the landing board of an active beehive, and allowed the opportunity to feed, undisturbed, upon the outgoing and incoming bees: they were left alone to feed freely without interruption until each voluntarily terminated the experiment by jumping off the platform. When this happened, the toad was again placed in position and given a second opportunity to feed. The eighteen toads which formed the subjects for memory and discrimination tests were each placed on the hives twice daily for seven consecutive days, having been starved for a week before the first experiment. After visiting the hive on the seventh day, the toads were allowed to feed freely upon mealworms for twenty-four hours. They then rested for a fortnight, during which they were kept without any food. After this interval the experiments were repeated as before, each toad being taken

to the hives twice daily for seven consecutive days. After the fourteenth visit they were again allowed to feed freely on mealworms for twenty-four hours. The feed of mealworms offered after each set of experiments was useful as a check to show that the refusal of bees was not due to loss of appetite or to sickness. The results of these tests are summarised in the following tables which give (i) the number of toads accepting bees on each of the seven consecutive days preceding (Exp. I), and following (Exp. II), the fortnight's interval; and (ii) the total number of bees eaten by the same series of toads during the above experiments.

	(i) Number of toads eating (*a*) bees							(*b*) mealworms.
Days	1	2	3	4	5	6	7	7–8
Experiment I . .	14	10	7	4	2	3	0	16
Experiment II . .	5	4	4	3	3	1	0	16

	(ii) Number of (*a*) bees eaten							(*b*) mealworms eaten.
Days	1	2	3	4	5	6	7	7–8
Experiment I . .	24	33	14	8	5	3	0	219
Experiment II . .	12	9	4	6	3	2	0	213

It will be outside the scope of these remarks to say anything of the toads' behaviour during the experiments, beyond mentioning that this behaviour was such as to support the only reasonable interpretation of the above results, which clearly prove (1) that bees are unpalatable to toads; (2) that even under starvation conditions and in spite of great and progressive hunger, these animals learn to refuse the insects entirely, though afforded adequate opportunities to take them; (3) that the slowest toads, in a series of eighteen individuals, learned to avoid bees in seven days; (4) that the lesson is wholly, or partially remembered for at least a fortnight.

A further point of interest (not brought out in the above figures), is that out of thirty-three toads used for the whole series of experiments, no fewer than nine individuals learned to avoid the bees after a *single* trial. In eight of these cases, a single bee was eaten at the toad's first visit to the hive; each toad, on subsequent visits throughout the week, would have nothing more to do with the insects.

I would like to draw attention here to an aggressive review by Dr. McAtee (5), written in an uneconomical and, I should say, frivolous style, dealing with a recent publication of mine (6). As I propose to reply in detail elsewhere, I will do no more here than quote two sentences which bear directly upon the present discussion. Dr. McAtee says:—"The whole of the experimental evidence as to edibility of prey is scarcely worth the paper it is printed upon, a fact pointed out by McAtee twenty years ago. . . . The citing of any amount of experimental evidence as to choice of food leaves the student of the natural feeding habits of animals entirely unmoved" (5, p. 212).

Evidence should not leave a scientist unmoved. Dr. McAtee, with a prejudice that has no place in science, chooses to ignore any facts that do not fall in line

with his own doctrine. His argument is as conclusive as that used by Lord Peter in the great debate between himself and his brothers, recorded in "A Tale of a Tub," when they respectfully submitted that his brown loaf was not mutton. "Look ye, gentlemen," cries Peter in a rage, "to convince you what a couple of blind, positive, ignorant, wilful puppies you are, I will use but this plain argument; by G——, it is true, good, natural mutton as any in Leadenhall market; and G—— confound you both eternally, if you offer to believe otherwise."

References.

(1) 1932, *Proc. ent. Soc. Lond.*, **6** : 94–96.
(2) 1932, *Smithson. miscel. Coll.*, **85**, (7) : 1–201.
(3) 1933, *Proc. Roy. ent. Soc. Lond.*, **8** : 113–126.
(4) 1934, *Proc. Roy. ent. Soc. Lond.*, **8** : 158–159.
(5) 1933, *Quart. Rev. Biol.*, **8** : 209–213.
(6) 1932, *Proc. zool. Soc. Lond.*, **1932** : 471–541.

Rejoinder (8 : 124) to Miss E. A. Oehlenschlaeger (7 : 98–100).

Prof. Poulton replied on behalf of his friend Miss Oehlenschlaeger, whose communication had not been received in time for the meeting (see below).

Dr. McAtee's arrogant reply is characteristic. The conspicuous Lepidoptera refused by the young Purple Martins were among the commonest and their patterns among the most easily remembered of the Nearctic species. Miss Oehlenschlaeger is a keen and most observant naturalist, helped by the Assistant Curator of Entomology in the Milwaukee Museum, and to suggest that their identifications "appear to have no scientific validity" is simply an exhibition of the discourtesy we have learned to expect from Dr. McAtee. Moreover, from his own point of view, it is gratuitous discourtesy; for the names of these species are of no importance in relation to his criticisms of the theory of warning colours, although extremely interesting to the serious student of the theory. The fact that eight different conspicuous butterflies and moths were refused while other inconspicuous ones were accepted is a disproof of McAtee's confident assertions, whether we label the insects A, B, C, etc., or by their scientific names. It is also worthy of note that a writer who objects so strongly to the method of experimentation * here makes the criticism—"There was no experimentation"; and makes it incorrectly, for Miss Oehlenschlaeger states—"any moth or butterfly with brilliant colouring was refused as food. We tried this thoroughly without avail." As to the futile remarks about the experience of the young Martins, this was naturally gained on the first occasion when they were offered or found for themselves and thus tested the taste or smell of the conspicuous insects.

Miss Oehlenschlaeger's reply to Dr. McAtee, received after the meeting, is printed below :—

I have just finished re-reading, with closest attention, Dr. McAtee's criticisms of my observations on the refusal of the Purple Martin (*Progne subis*) to accept

* See the concluding paragraph of McAtee's paper (1912, *Proc. Acad. Nat. Sci. Philad.*, **64** : 364)—"Since this evidence [contents of stomachs, pellets, castings, etc.] is sufficient in itself, and since experimental data must be supported by it to be worthy of any consideration, why perform the experiments?"

brilliantly coloured insects as food. I regret very much that these records are of no value to Dr. McAtee, but the fact that they agreed with those of many other naturalists gives value to an experience upon which I came quite accidentally. I am not an entomologist, and know very little of insect mimicry, and the laws which govern it, or of warning coloration; but I hope I have intelligence sufficient to observe and record unusual behaviour in young birds which I had watched very closely for two months. The insects of bright coloration which were refused by my Martins are common species, abundant here during the summer. I have always known them, and my visits to the Milwaukee Museum were not made, as Dr. McAtee implies, for a late identification and the refreshing of an uncertain memory, but in order to obtain the recognised scientific names. I realised that this information was necessary in order to answer Prof. Poulton's questions. When the four young Martins arrived at my home their condition indicated the immediate need of food and moisture. I was unable at the time to gain any information about their natural food at this period of life, from any available ornithological literature or from my scientific friends. It thus became obvious that extreme care would be necessary in attempting to solve the problem by experiment—the only possible method.

The discussion held before the Entomological Society of London at its meeting on Dec. 7, 1932, gives a very clear and concise idea of Dr. McAtee's theory, elucidated by Dr. R. A. Fisher, F.R.S. The overwhelming mathematical, statistical and scientific data which it necessitates, are quite beyond my comprehension, but nothing that Dr. McAtee or any other ornithologist or entomologist may assert can throw doubt upon the observations made by my own eyes on the work of my own hands. Nor do I agree with Mr. Uvarov that the experiments were carried on under "unnatural conditions" (**7 :** 86). Any one having a love for young birds and the patience to observe their behaviour can eliminate the first two letters of the adjective. The birds were perfectly free, but also, perfectly confident. And, may I add, that *Progne subis* is by far the most intelligent of the birds known to me, although his memory is not as persistent as I might wish, for, on his return from the southward migration, the former confidence was forgotten no less than the association of a green dish with the favourite diet of mealworms!

The list of insects accepted and rejected by the Martins is printed on pp. 98–99 of the "Discussion" on Dec. 7, 1932. Possibly the very simplicity and limited duration of the enforced experiment renders it valueless for Dr. McAtee, but I can hardly be blamed for bringing to a close the series of observations which threatened the well-being of my birds. At the time, my interest in their previous behaviour ceased with the arrival of a box of mealworms from Chicago! But the desire to learn *why* the brilliant or strikingly coloured insects were rejected had become definitely fixed in my mind. I did not realise that my wish would find its fulfilment in the arrival of a copy of Prof. Poulton's address to the Zoological Section at the Centenary Meeting of the British Association in London, 1931. In this address—"A Hundred Years of Evolution" (pp. 89–92) I found the answer to my Insect–Martin riddle. It fitted absolutely with my observations, which, at the time, were both unbiased and untutored. Can it be maintained that the observed results were affected or rendered in any respect less valuable because the experiments were undertaken in the hope of providing food and without any intention

of carrying on a scientific investigation? And are four normally developed bird appetites, closely watched by an extremely interested group of intelligent people, worth less as evidence than the mutilated remains in a dead bird's stomach? Of "availability" there was a-plenty during those anxious days from August 26–Sept. 3, 1931, for the brightly coloured insects were offered to the birds in great numbers—with wings, without wings, the body entire or in part. But this, to me, horrid piece of work, was perfectly useless. Neither hunger nor "availability" aroused the desire in my Martins to eat conspicuously coloured butterflies.

Differences of opinion are natural in all scientific pursuits but I believe it has always been customary, in Natural Science, to accept in perfectly good faith, the statements of trustworthy laymen and women. If I, without any previous knowledge of the laws governing insect mimicry, have made observations leading to the same conclusions as those reached by Prof. Poulton and many others—conclusions which have been so abundantly confirmed, then I am most happy to have been able to add my very small part in still further support of their work and its interpretation.

Dr. McAtee's paper of 1912 concludes with the question—"*Why* perform the experiment?" Are not "Why?", "How?", and "What?" the dynamos that drive the Scientist's mind?

Evidence of the effectiveness in Nature of the Protective Adaptations in some insects (7 : 100–105).

Prof. Poulton replied to the concluding section of the rejoinder (8 : 124–126) as follows :—

Dr. McAtee may rest assured that there has never been anything of "a thrill" in this controversy, conducted not with the slightest hope of convincing him, but in order to prevent others from being misled by his confident assertions shown on previous occasions and here again to be without foundation.

Referring to evidence quoted from the Biological Survey bulletins (*Proc.*, **7 :** 100–104) Dr. McAtee replies that "all of the excerpts cited . . . are based on data which was [*sic*] incorporated in the grand assemblage upon which my Smithsonian paper was based. The whole is greater than any of its parts" (p. 124). Comparing then "the whole" with "the parts" and printing the latter in italics we find (full references in *Proc.*, **7 :** 100–104) :—

Carabid beetles. "It is everywhere evident that the special defenses alleged . . . are more in the nature of pleasing fictions for theorists to speculate upon than practical reliances for the beetles concerned."—"*. . . either absent, or found but rarely in these birds' (thrushes, bluebird) food . . .*" Also, referring to the Hermit Thrush, "*. . . Carabidae are noticeable by their absence, as only a few remains appear.*"

Coccinellid beetles ". . . are freely eaten. No better example of the influence of availability in guiding choice of food by birds could be desired . . ." ". . . in California where Coccinellids are notably more abundant than they are in the eastern States, a larger number of birds feed upon them and they get a great many more of the beetles."—*Summarising Prof. F. E. L. Beal's record of the insect food of Californian birds we learn that, with the possible exception of the Pigmy*

Nuthatch, the only serious attacks on Coccinellidae are made by specialised enemies in the single genus Vireo, *and in this genus by all the species.*

The honey-bee—" Bees all sting [an incorrect statement], and the 797 records . . . would seem to indicate considerable disregard for the stings on the part of birds." " Thirty-two species of birds took honey bees . . . on a total of 118 occasions. . . . These numbers . . . seem in fair proportion to the availability of the bees concerned."—*In* 375 *stomachs of the Cliff or Eaves Swallow " the remains of* 35 *honey bees . . . were identified in* 13 *stomachs. . . . All were* [stingless] *males or drones. . . . Evidently the drones are deliberately selected by the eaves swallow. . . ." Honey bees were also represented by* 11 *drones in* 205 *stomachs of the Purple Martin, by* 1 *drone in* 467 *stomachs of the Barn Swallow, and were absent from the stomachs of two other Swallows.*

All the solid evidence summarised in the italicised sentences is dismissed by Dr. McAtee as " stray crumbs " of comfort for " selectionists," reminding us of the excuse made by a girl when blamed for having a baby—" It was such a little one ! "

With regard to McAtee's " *Conclusion* " (pp. 124–6), the simplest form of reply will be to make a brief statement of certain opinions held by Darwinians, thus correcting the supposed beliefs which exist in the author's imagination.

Darwinians hold not only that protective adaptations but also that numerical factors have an important bearing on predation and they entirely agree with the passage quoted from Swynnerton (p. 124 note).

To McAtee's question—" Is not cryptic coloration often hailed as a nearly perfect defense ? ", we reply—" No, and never correctly." On the contrary, Darwinians believe that this form of protection has been gradually evolved by the successful attacks of enemies and by the same means kept at a high level when attained. Cryptic species are far more numerous than aposematic and supply the bulk of the food eaten by insectivorous animals.

Referring to this belief McAtee continues—" The selectionist argument thus admits that many species are relatively unprotected and suffer more severely than protected forms from predatory attack." The species which McAtee describes as " relatively unprotected " are on the contrary extremely well protected by cryptic adaptations and suffer in greater numbers because they are themselves far more numerous and are hunted by a much greater number of enemies.

Since these cryptic species " maintain their numbers," McAtee concludes " we have proof that protective [warning] adaptations are not essential." This wonderful example of the *non sequitur* may be condensed as follows :—

Many species with cryptic adaptations maintain their numbers.

Fewer species with warning adaptations maintain their numbers.

Therefore warning adaptations are of no value in the struggle for existence !

McAtee continues—" On the other hand if all organisms have protective ' adaptations,' then the fact must be faced that predatory and other enemies must live, in fact do live and maintain their numbers, again demonstrating that the ' adaptations ' are not of decisive importance."

This confident assertion with its reiterated " must " is at once shown to be hollow by a glance at the record of animal extinction and evolution preserved in

the earth's crust. Again, considering the predators alone, can anyone maintain that their keen senses and swift correlated movements are not of decisive importance when we know that the struggle is severe enough to cause the extermination of all but a small fraction of each generation? Can it be doubted that the efficiency of this surviving fraction will be of a high standard and will tend to include those variations which would carry it to a still higher level? And the same argument applies with even greater force to the insect prey because, as compared with the Vertebrate predators, the surviving fraction is much smaller and the generations follow each other more rapidly.

Truly we may agree that there is something to be said for Dr. McAtee's conclusion that "the subject is one certainly best treated according to general principles."

Judging from an article in "Nature Magazine," Baltimore (Mar. 1934), to which my friend Dr. F. Morton Jones has directed my attention, Dr. McAtee deprecates the attempt to explain the adaptive meaning of structure but is willing to make an exception in favour of function. Thus in this article, "Tree-hoppers, Insects Worth Knowing," he writes on p. 119 :—"There has been much speculation about the utility of the bizarre structures of membracids, but that had better be left to the speculative. Need everything be placed on a basis of utility? Are the marvels of tree-hopper form any more in need of explanation than the comeliness of a flower, or the beauty of a sunset?" But on the next page he gives the following surprisingly different interpretation,—not to form this time, but to function :—"The nymphs share with adults a defensive habit of sidling around a plant stem so as to keep it between them and an intruder."

The majority of naturalists will hold that the beautifully detailed resemblance of *Umbonia* to a thorn is no less defensive than the movements described above, and they will altogether deny the conclusion that the qualities which give to a flower its comeliness, are useless to the plant itself.

Darwinians hold that the struggle for existence is extremely complex and that it is only carried to a successful issue by the help of *many* essential adaptations, among which Protective or Cryptic Resemblance is necessary for the existence of an immense number of species, and Special Protection with Warning Characters for a far smaller number. They hold that each of these adaptations depends for its efficiency upon the co-operation of various distinct subordinate adaptations and that all these have gradually reached and then maintained a high level of perfection by the elimination of the unfit and the consequent "survival of the fittest" through a long period of time during which there has been much adjustment and readjustment to changing conditions.

Comments on the Discussion on "Protective Adaptations of Animals, etc.," 7 Dec. 1932 (*Proc. ent. Soc. Lond.*, 7 : 79–105) in 1933, *Ibis*, (13) 3 : 800–1.

The following copy of these comments, sent by Mrs. M. D. Brindley, F.R.E.S., will, it is believed, be of interest to Fellows :—

"A most interesting discussion was initiated at the meeting of the Entomological Society on 7 December, 1932, on Dr. McAtee's paper entitled 'Effectiveness in

Nature, [etc].' We have not been favoured with a copy of this paper, but, judging from the discussion on it, Dr. McAtee appears to have based his opinions on the examination of some 80,000 stomach-contents, and come to the conclusion that phenomena classed as protective adaptations have little or no effectiveness against predators, that the efficiency of warning colours in the prey is questionable, and that availability is undoubtedly the chief factor involved in the choice of birds' food. Such statements naturally open up many and varied points of view, and the discussion, in which several prominent entomologists and others took part, elicited a good deal of damning evidence both against Dr. McAtee's conclusions and the statistical methods at [on] which he arrived at them.

"We cannot here do more than call the attention of ornithologists to this paper and the discussion on it, the perusal of which will well repay those who are interested in the subject. A wide field is open to those who have the time to study the exact food of various birds—their preferences, aversion or toleration, and the relation of these to nauseating properties, warning colours, mimicry, defensive weapons, etc., in the prey.

"We should have thought that, in England, at any rate, Dr. McAtee's conclusion that availability is the chief factor involved in the choice of food by birds, and that, therefore, selection plays no part, could be controverted by every-day observations in the countryside. We can call to mind caterpillars of the Small Tortoiseshell abundantly available which no birds except Cuckoos seemed to touch, and surely the earthworm must be among the most available of foods, yet the preference shown for it by the Song-Thrush, amongst the thrush tribe, is pronounced. The garden-snail is as available to the Blackbird as it is to the Song-Thrush, yet there is a marked preference for it only by the latter."

Communications.

The conspicuous *Papilio* (*Pharmacophagus*) *hector* L. refused by a Ceylon Lemur.

By Prof. Poulton.

The specimen referred to in the following letter written 4 March, 1934, by Mr. W. W. A. Phillips of Mousakande Group, Gammaduwa, Ceylon, was exhibited:—

"I have another Loris here, which I have had for some months in captivity, but I have been too busy of late, to carry out many feeding experiments. The enclosed *Papilio*, however, I gave to him one day, and it lived in the cage for three days. He refused to look at it, and I consider that it is a very good example of *warning colours*, showing their effectiveness. The butterfly is a common one in the low country and lower hills, and is generally seen fluttering close over the ground. I *have never* seen it attacked by any insect-eater."

The above recorded observation is an interesting addition to Mr. Phillips' notes * on the acceptances and refusals of insects by the Ceylon Lemur, *Loris tardigradus grandis*. In these earlier experiments the conspicuous *Papilio aristolochiae ceylonicus* Moore, allied to *hector*, was also refused by the Lemur (1932, **7**: 35, 50).

* 1931, *Proc. ent. Soc. Lond.*, **6**: 51; 1932, **7**: 32, 49.

Birds as Enemies of Dragonflies in Norway. By Prof. Poulton.

The Registrar has kindly told me of a brief but extremely interesting paper on this subject by Sven Sømme (1933, *Norsk Ent. Tidskr.*, **3** : 223–4). The observations recorded by the author are a most valuable addition to those published by Miss E. L. Turner and Mr. F. J. Killington in our 1932 (1933) *Proceedings*, **7** : 97. A rather full abstract of the paper is printed below.

In his opening paragraph the author refers to the numbers of Odonate wings he had found along the beaches of lakes or rivers—" sometimes in great abundance. Certainly this is a very common phenomenon. Actually one may very seldom examine shores of lakes during the time when dragonflies emerge without finding wings. As a rule, the wings belong to species of *Anisoptera*, but sometimes also to *Calopteryx*." He then refers to the statements of Wesenberg-Lund, Bird, and others that birds devour the insects " especially during the period of emergence "; also the conclusion of the first-named authority that Fringillidae (sparrows and others) are chiefly responsible for such attacks. In the author's opinion, however, these birds are not generally of great importance as enemies of dragonflies in Norway, and he states that he has " never seen sparrows taking dragonflies under natural conditions. In June 1931, however," he continues, " I hatched some specimens of *Somatochlora metallica*, at the Zoological Museum, Oslo, and one or two days after emergence I took them out and let them fly. They had hardly left my hand when they were seized by sparrows, which had their nests under the roofing of the building. The bodies were eaten, but the wings fell to the earth." At the same place and in the same month he bred some *Libellula quadrimaculata* L. and *Cordulia aenea* L., " and on the day after emergence . . . let them fly from the window. Before they had flown 50 meters, they were all seized by wagtails and eaten, their wings falling to the earth."

Among the birds which he observed seizing dragonflies under natural conditions the author mentions the chaffinch (*Fringilla coelebs* L.), although " this bird does not generally occur in numbers near water-edges." In Hof, Solør, 28 Jun., 1929, however, he saw many of them and especially wagtails in the neighbourhood of ditches " where dragonflies were emerging in great numbers. Lots of dragonfly wings, all belonging to the genus *Aeschna* (most of them females) were scattered about on the beaches."

The importance of the wagtail as an enemy of dragonflies was shown by the following observation :—At Mangen, on 20 Jun. 1930 he found *Leucorrhinia dubia* v.d.L., abundant but so lively that they were very difficult to capture although wagtails were seen catching and killing many specimens. On the following day, near Mangen, a wagtail was observed to seize a recently emerged *Onychogomphus forcipatus* L. By the banks of the river Hobøl in Østfold on 6 Jun. 1930 the exuviae of *Gomphus vulgatissimus* L., showed that great numbers, estimated at 10–20,000 per kilometre, had recently emerged, while the discarded wings proved that a high percentage had been immediately killed. No captures were seen but the wagtail was the only common bird along the river. Two days later at Unemselven, Svindal, Østfold fylke, very few wings were seen and " wagtails were scarse [sic], but the common sandpiper, *Actitis hypoleucos* L. was common."

On 24 Aug. 1930 a kestrel, probably *Cerchneis tinnunculus* L. was seen " hunt-

ing dragonflies over a small lake near Svindal, Østfold fylke. The bird was sitting in the top of a pine, now and then taking a flight over the tarn to seize a dragonfly." Twice he saw it catch *Aeshna grandis* L.

In conclusion the author emphasises the "very great and important loss of individuals . . . during and shortly after emergence." In his opinion "birds represent the greatest danger to the semiadult dragonflies," while "in Norway the most dangerous enemy . . . is the common wagtail. . . . To some extent this bird also feeds on adult Odonata." The kestrel "is probably most dangerous to adult ones, especially late in summer when some of the species (such as *Aeshna*) are frequently flying very high."

A print showing the Reed-warbler (*Acrocephalus scirpaceus* Herm.) carrying a dragonfly to its nestlings. By Prof. POULTON.

A copy of an excellent print kindly brought to his notice by the Registrar was exhibited on the screen. It had been reproduced from a photograph taken by Hermann Fischer and was published in "Spemanns Natur-Kalender—Juli 1934." A brief account of the natural history of the "Schilfsänger" is printed at the foot of the illustration. His friend Mr. F. J. Killington was confident that the dragonfly represented belonged to the LIBELLULIDAE and was, he believed, a species of *Sympetrum*, the depressed position of the wings being very characteristic of this genus. The abdomen, apparently somewhat dilated towards the apex, was probably that of a male.

The insect-food of two species of Chinese frogs in the vicinity of Kashing. By Prof. POULTON.

My friend the President has kindly shown me a recently published paper * of much interest, dealing with this subject. The main results are given in Table I (pp. 184–87)—an analysis of stomach contents undertaken in 1932 and based on the specimens extracted between 28 Apr. and 11 Oct., 1932, from 170 *Rana limnocharis* Wiegmann and 50 *R. nigromaculata* Hallowell, chiefly captured in rice-fields but also in other fields, meadows and orchards. The frogs were killed at once "to prevent further digestion and were then preserved in 4% formalin before dissection." All the prey were adult unless otherwise stated.

In the abstract printed below, the first of the two numbers following each group gives the number of specimens extracted from 170 *limnocharis*, the second from 50 *nigromaculata*. The totals of the Insect Orders and the Invertebrata other than Insecta are quoted from Table III (pp. 188–89).

Among the Invertebrata outside the Insecta (totals: 118 + 31) there were found—Spiders: 32 + 12; Scorpions: 15 + 2; Ticks: 1 + 0.

Hymenoptera (totals: 181 + 18) included BRACONIDAE: 3 + 0; CHALCIDIDAE: 15 + 0; MUTILLIDAE: 1 + 0; FORMICIDAE: 156 + 16; unclassified Hymenoptera: 6 + 0. The absence of Vespoidea, Sphecoidea and Apoidea is significant.

* LIU (Chi-Ying) and CHEN (Kan-Fan). "Analysis of the Stomach Contents of two Species of Frogs (*Rana limnocharis* and *Rana nigromaculata*) in the Vicinity of Kashing with special Reference to Insects."—*Yearb. Bur. Ent. Hangchow*, **2**: 183–191. Hangchow (1932), August 1933. (With a Summary in Chinese.)

Among the numerous Coleoptera of many groups (totals: 102 + 25) the Coccinellidae are only represented by *Propylaea japonica* Thunb.: 7 + 1, its presence being "certainly due to the infestations of aphid colonies on rice plant and winter vetch, a common green-manure crop in this region" (p. 191). The Chrysomelidae are also few: 8 + 1. Other Phytophaga were *Monolepta nigrobilineata* Mots. (Galerucinae): 11 + 2; *Abirus fortunei* Baly (Chrysomelinae): 0 + 1; *Phyllotreta vittata* F. (Halticinae): 2 + 0, the last-named yellow-striped flea-beetle perhaps owing its origin to vegetable gardens or vegetables planted in orchards (p. 191).

Lepidoptera, all as larvae, included only the following:—Pyralidae: 0 + 1, also *Chilo simplex* (Crambites): 2 + 0 (supposed to be eaten during migration); Geometridae: 2 + 0; Noctuidae: 6 + 2; Hesperiidae (*Parnara guttata* Brem.): 1 + 1; unclassified Lepidoptera: 22 + 0. The relatively small totals: 33 + 4, are remarkable.

The totals of the Hemiptera and Homoptera, both of many groups, were 15 + 2 (plus 5 eggs) and 90 + 15, respectively, the latter including 60 + 7 Aphididae.

Orthoptera in many groups totalled 29 + 5, the Blattidae being only 0 + 1.

The totals of other prey for comparison with the above were:—Ephemeridae: 1 + 0; Odonata: 1 + 0; Trichoptera: 2 + 0; Diptera: 92 + 19; unclassified Insecta: 3 + 0. Under the Hymenoptera, however, this last record stands as 3 + 2.

The authors conclude that the "stomach contents . . . shown in Table I represent a more or less typical sample of the terrestrial and aquatic insect components of a rice field in this region" (pp. 190–91), and that "numerical abundance seems to be a very important factor" (p. 189)—an importance recognised by every naturalist, although not so far as to neglect the significance of other factors. Thus we cannot believe that bees, wasps and Fossors are absent from the rice-fields while the single Mutillid may have been a stingless male. It is most improbable that the Coccinellidae are represented by only a single species of ladybird and the Phytophaga by no more than the species named, or that the 17 Hemiptera and the single Blattid represent the proportionate abundance of their groups.

Striking concerted aposematic defence by a gregarious Burmese caterpillar. By Prof. Poulton.

My friend Mr. A. H. Hamm has noticed and kindly copied for me the following interesting passage in Capt. F. Kingdon Ward's book.* The date was about 7 July, 1914, inasmuch as the previous chapter closed with 30 June.

"Little more than a week later we set out a second time for Imaw Bum, but alas! by this time the weather had suffered a relapse.

"As before, we made straight for the Ngawchang Nka over hill and dale, sleeping just above the river.

"Pushing through the thick growth in the stream bed hard by the Yawyin village where we had slept previously, my attention was attracted to the strange circumstance of some tall stinging nettles rocking to and fro in still air, and turning

* "In Farthest Burma," Lond., 1921, chap. v, p. 81.

to them I found that this motion was caused by a number of large caterpillars agitating the leaves. These formidable larvae, apprehensive at my approach, had raised their heads, snake-like, and darting them rapidly to and fro caused the leaves on which they sat to shiver and tremble in the manner described. The trembling motion became still more marked as I looked closer, and when finally I touched one, several of them ejected at me, with considerable violence, drops of dark green fluid. Such mummery is evidently designed to scare away some enemy, but whether bird, spider or insect I did not ascertain."

It is probable, as Mr. Hamm suggests, that the larvae were those of a Nymphaline butterfly, exhibiting in a far more extreme form the protective adaptations of some of our British nettle-feeding VANESSIDAE which also eject a green fluid—especially plentiful in *Nymphalis io* L.—and exhibit concerted movements, on disturbance. The conspicuous movement described by the author as imparted to the food-plant is particularly interesting.

[Since these words were written I have communicated with the author who kindly wrote, 20 May, 1934 :—" I have now looked up the reference in my diary. No size is given but the context has brought back a memory of the larva which I recollect as about 2 inches long, dark and spiny, like a ' Peacock Butterfly ' caterpillar."—E. B. P.]

English names of British Moths recorded by William Jones of Chelsea :—a correction. By Prof. POULTON.

Mr. H. M. Edelsten and Mr. W. H. T. Tams, while preparing a complete list of these English names with their scientific equivalents, have detected two mistakes in the determinations published in 1933, *Proc. ent. Soc. Lond.*, **8** : 103.

The " Pretty Widow " determined as *Schistostege decussata* Schiff should have been *Eupithecia venosata* F. The error arose because *decussata* is a synonym of the latter species, which is evidently intended.

Similarly the " Green Huswife " should have been *Hemithea aestivaria* Hb. and not *Thalera fimbrialis*, *thymiaria* being a synonym of both these.

Furthermore, the comparison between William Jones' English names and those given by Haworth in the " Lepidoptera Britannica " has shown that the " Chimney Sweeper's Boy," supposed to be the same species as the " Chimney Sweeper," *Odezia atrata* L. (*loc. cit.*), was the name given to the Psychid moth *Fumaria plumistrea* Hübn., placed as a synonym of *Epichnopteryx pulla* Esp. by Staudinger, a conclusion accepted by Meyrick in his " Revised Handbook of the British Lepidoptera," Lond., 1927 (Preface). The four other species of *Fumaria* recognised by Haworth (" Lep. Brit." : 373, 374) are all named as various forms of " Chimney-Sweeper "—the " transparent," " light," " shining," and " lesser "—while the Geometrid *Phalaena chaerophyllata* F. (*O. atrata*) is appropriately distinguished as the " looping Chimney Sweeper." The above information has been kindly supplied by my friends Mr. E. Meyrick, F.R.S., and Mr. Tams, the latter having written :—" The genus *Fumaria* Haworth belongs to the PSYCHIDAE, and has for type, according to Durrant, *F. casta*. Haworth's citation of Hübner's figure Tinea, no. 213 (*plumistrella*) is incorrect, and the insect he refers to is *Epichnopteryx pulla* Esper (cf. Meyr., Kirby and Staudinger). See also Dalla Torre and Strand, *Lepidopterorum Catalogus*, **34**,—PSYCHIDAE, and Tutt, ' British

Lepidoptera,' 2. Hübner's *T. plumistrella* is now known as *Lepidoscioptera plumistrella*."

The dispersal of freshly emerged insects as an adaptation to prevent in-breeding. By Prof. POULTON.

I have received a letter from my friend, our Hon. Fellow Dr. L. O. Howard, referring to p. 169 of the Annual Address, 17 Jan. 1934 :—

20 *Mar.* 1934.—" We have known for 20 years or more, in our work in importing, rearing and liberating parasitic insects, that we cannot expect success in establishing new forms unless we liberate them *in large colonies*—several hundreds or a thousand—since their first impulse is to *disperse* far beyond the possibility of mating. So you see the exact parallel with your observation. I am sure that I have mentioned the fact many times in print, and surely it occurs in Bulletin 91 of this Bureau by W. F. Fiske and myself."

My friend Dr. S. A. Neave, our President, has very kindly sent me a copy of the following quotation—referred to by Dr. Howard—from the 1911, *U.S. Dept. Agric. Bur. Ent. Bull.*, **91** : 14, entitled " The Importation into the United States of the Parasites of the Gipsy Moth and the Brown-tail Moth : A Report of Progress, with some consideration of previous and concurrent efforts of this kind," by L. O. Howard and W. F. Fiske :—

" It was first thought that when parasites had been reared in sufficient numbers they should be widely distributed in small colonies, on the theory that each colony would remain in substantially the same general locality and would increase and spread from that point. This idea was a natural one and was fully justified by previous work which had been done with parasites of other groups of insects, but in this case it proved to be erroneous, and valuable time and valuable specimens were lost. Eventually it was shown to be of prime importance, first to establish a given species of parasite in this country, and not until this has been accomplished to pay any attention to the matter of dispersion. It seems to be the first instinct of many species that have been imported to spread widely. Therefore, if the colony put out be a small one the individuals composing it spread rapidly beyond all means of meeting and of mating, and thus the colonies in many instances were lost. By rearing in the laboratory, however, until colonies of at least a thousand are to be had, such colonies while dispersing are much more likely to remain in touch, mate, and multiply."

Dr. Neave adds :—" So far as we have been able to find them, other remarks by Dr. Howard on the same subject appear to refer back to this Bulletin."

The food-preferences of the starling. By Prof. POULTON.

I have also received a letter kindly written 14 Apr. 1934 by Dr. H. N. Kluijver, referring to pages 160–1 and 170–2 of the last Annual Address :—

" I very well agree with the conclusions you drew from my observations. I also drew attention to the fact that slugs and Curculionids occurred in the food in much smaller quantities than could be expected. I supposed that the starlings have a preference for other animals.

" It may perhaps interest you to know that the two *Euchelia jacobaeae* L., [pp. 161, 170] were captured when leaving their pupae."

Dr. L. O. Howard had also written in the letter quoted on p. 45 :—" The European Starling, which is becoming much of a nuisance with us, is said to feed avidly on the Japanese beetle (*Popillia japonica* Newm.)."

A note on the Ortalid fly *Callopistromyia annulipes* Macquart. By J. M. Aldrich.*

" *6th April*, 1934.

" I am sending you now a box containing three specimens of an ortalid fly—*Callopistromyia annulipes* Macquart. One of these I collected on the wooden railing of a bridge in a park in this city [Washington]. It was all by itself and was holding its wings vertically and apparently strutting, walking at a slow pace. After capturing it I took some trouble to mount it with the wings in the strutting position; and I was rather surprised to see that it is a female. I have seen one other specimen of the same species going through a similar performance and it was also a female. I did not mount it with the wings erect in this case.

" The speckled appearance of the fly, together with the fact that it is ordinarily found on trunks of trees or old logs where it matches its surroundings extremely well, would seem to indicate protective coloration, but the habit is quite different."

An apparent gynandromorph of *Kallima inachus* Bdv. By Prof. Hale Carpenter.

The specimen exhibited bearing data " Khasi H(ills) 1910 " was discovered by Commander J. J. Walker, R.N. It is noteworthy for the much greater size of the right wings. On closer inspection the suggestion that the larger wings are of the female type is borne out by the fuller outline of the hind-wing along the outer margin anterior to the tail. There is no great difference between the appearance of the two sides above, save for the point to be mentioned later, but beneath there is a striking difference.

The smaller, left, wings are of the wet-season form, with the costal and anal angles not greatly prolonged and showing considerable mottling with dark and light brown, and speckling which resembles the fungus growth on a wet dead leaf as Prof. Poulton has pointed out.

The larger, right, female, wings are of the dry-season form, showing the typically elongated pointed or hooked tip to the fore-wing and longer tail, and a lighter, more uniform brown ground-colour with less conspicuous mottlings and apparent fungus marks.

While the wings appear to be of two sexes both front legs show the characteristic appearance of the male Nymphaline.

There is no evidence that the specimen is an artifact, and Mr. N. D. Riley and Dr. H. Eltringham, F.R.S., who kindly examined the specimen, agreed that it appears to be a natural product.

The specimen was among a number of the duplicates in the collection given to the Hope Department, Oxford University Museum, by the widow of the late Col. Turenne-Jermyn, and appears to have been unobserved. This fact also is of importance as showing that it was not obtained as a specimen of great interest, and therefore is not likely to be a deliberate artifact.

* Communicated by Prof. Hale Carpenter.

Attacks of birds and other enemies on butterflies. By Prof. Hale Carpenter.

There are many difficulties in the interpretation of marks on the wings of Lepidoptera, and a specimen was exhibited to illustrate this.

Commander Walker, R.N., has presented to the Oxford University Museum a *Salamis antera* Ward, from Madagascar, bearing on the upper surface of the right fore-wing an elongated triangular mark, very sharply defined, which might be held to be the imprint of the beak of a kingfisher such as was illustrated in the *Proceedings* for 6 Dec. 1933. The mark extends from the outer margin, its limbs corresponding roughly with veins 3 and 4, to the inner edge of the costal vein: the costal vein itself is not damaged. Were this mark at all represented on the under surface it might justly be considered the work of a kingfisher.

If the butterfly had been seized while the wing was outspread flat on a leaf it is possible that the leaf might also have been gripped and would have prevented the lower mandible from marking the wing.

The mark is so straight and regular that it is very difficult to account for it as a scratch from a thorn or anything else, unless it had been accidentally inflicted after death by mishandling. If it was the result of forcible folding of the wing in the net, as sometimes happens, it is difficult to understand how the apex of the fold at the costal margin, did not break the costal vein.

A further point of interest is the fact that each hind-wing has a piece excised from the hind margin, the gap being at the end of vein 2 on the left wing and vein 3 on the hind-wing, but they could have been due to a bite by a bird on both wings when closed not quite in perfect alignment.

The following Palaearctic Lepidoptera were exhibited showing evidence of attacks by birds as described in each case. They were collected by Fleet-Paymaster T. Bainbrigge Fletcher, R.N., who had kindly presented them to the University collection at Oxford.

1. *Polyommatus icarus* Rott, a male in fresh condition from Hautes Alpes, Lauteret, 6 Aug. 1932. The outer half of the left hind-wing and a large part of the right hind-wing internal to vein 2 are torn away. The left fore-wing bears a narrow triangular imprint directed forwards and inwards from the middle of the inner margin towards the costa. The base of the mark corresponds with the outer torn edge of the hind-wing: it is visible on the under surface.

2. *Agriades bellargus* Rott, a male, Stroud, 8 Aug. 1933, in very fresh condition. Each fore-wing bears a triangular mark, broader than in the last case, extending from the inner margin, just internal to the anal angle, forwards and slightly inwards to the costa. The mark is less distinct on the underside, but can be traced. On the right wing the limb of the mark nearest the body is distinctly more rubbed. Each hind-wing bears a single scratch running backwards and inwards from a point opposite to the end of the inner limb of the mark on the front wing. It would appear that this is due to the tip of the bird's beak having passed between the closed hind-wings to seize both fore-wings, when the butterfly was at rest.

3. *Agriades corydon* Poda, a male, Martigny, 8 Sept. 1925. Both hind-wings have had the outer margin cleanly sheared off from the anal angle to the costal angle, leaving an almost straight edge. In addition the right fore-wing bears a triangular mark extending forward from the anal angle to the costa, the better-

marked inner limb being just internal to the angle, and the outer limb on the hind margin at vein 2. The mark is clearly visible on the under surface, and presumably represents a further snap at the butterfly after the margins of the hind-wings had been shorn off.

4. *Agriades corydon* Poda, a male, Valais, Berisal, 5000 ft., 1 Sept. 1926. A V-shaped piece has been cleanly cut out of the right hind-wing, leaving a gap between veins 2 and 6, extending to the base of the cell: on the left side the greater part of the wing has been cut away anterior to vein 2. Evidently the two hind-wings were seized in the position of complete rest.

5. The Geometrid moth *Tanagra chaerophyllata* Linn., Valais, Berisal, 5000 ft., 7 Aug. 1926. The two right wings appear to have been seized when the fore-wing lay on top of the other: each bears an extremely clear imprint directed *backwards* from the anterior margin to the anal angle, and best described as a truncated cone with base on the costal margin. The imprint is that of a large beak whose apex extended beyond the hind margin of the wings, for it is not shown on the wing. The interest of this mark is that it shows that the attack was from in front, whereas in all the LYCAENIDAE previously mentioned, bearing spots along or near the hind margin, the attack was from behind.

6. *Zygaena exulans* Hochw., Hautes Alpes, Lauteret, 5 Aug. 1932. Found lying on a rock minus head and abdomen but with the wings indicating that it was a fresh specimen. Whatever enemy had attacked it had not cared to finish it. Bainbrigge Fletcher stated that there was a fresh bird-dropping on the rock, and the headless moth was still alive. This exemplified the toughness or strong hold on life which was characteristic of aposematic species such as *Zygaena* and would sometimes enable them to emerge little harmed from an encounter with a not-too-hungry enemy.

The following Indian butterflies were also exhibited which had been collected by Lt.-Col. F. C. Fraser, I.M.S., who had kindly presented them to the Oxford University Museum.

1. *Kallima horsfieldi* Koll., male, Kotagiri Ghat, Nilgiris, 23 July, 1933. Both hind-wings had a large piece shorn away from the anal angle to the level of vein 4 on the hind margin: the appearance suggests that it was done by a lizard.

2. *Discophora tullia* Moore, Coorg, Mangalore Ghat, 23 May, 1923. Both hind-wings had a gap between vein 1*b* and 3 extending for about half an inch into the wing. The breadth of the inner end of this gap suggested the mouth of a lizard rather than a bird.

3. *Eriboea athamas* Dru. from Coimbatore District. A broad piece has been torn or cut from each hind-wing extending forwards as far as vein 3 and along the anal margin to the level of the tip of the abdomen. This also suggests a lizard.

Col. Fraser in a MSS. note attached to specimens 1 and 2 stated that these highly procryptic species had "yet been open to attack." But surely it is expecting too much of any protective device to assume that it will secure immunity to all its bearers always? Moreover, it is only by such attacks that selection can work: a bird or lizard which caused *no* loss to a species could not, *ipso facto*, act as a selective agent. Thirdly, in spite of attack these butterflies had escaped with their lives, since they were captured by Col. Fraser. The brittleness of the wings and their large expanse had resulted in an injury of no consequence.

A new and very distinct subspecies of the coast-frequenting Tortrix *Polychrosis littoralis* Westw. (Curt.). By H. J. Turner.

The specimens exhibited were taken by Dr. H. D. Smart, F.R.E.S., on Annet island in the Scillies. After examination and comparison with specimens in the British Museum a male was examined by Mr. F. N. Pierce who reported that the genitalia were identical with that of typical *littoralis*. The new subspecies is so distinct, however, that I have named it *P. littoralis* subsp. *annetensis* in the 1934, *Ent. Rec.* **46** : 52.

A living spider imported into England. By Prof. W. A. F. Balfour-Browne, F.R.S.E.

The spider exhibited was found in a consignment of bananas imported into this country. It had not yet been possible to identify the species, but this would be attempted later.

Wednesday, 6th June, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

Exhibits.

The following communications were made to the meeting :—

The habits and parasites of *Selenis suero* Cram. (Lep., Noctuidae). By J. G. Myers, Sc.D.

(Communicated by the Secretary.)

In October, 1932, in the small and isolated Kurasabai Savannah, in the foothills of the Pakaraima mountains of British Guiana, I found a very curious boring caterpillar, which proved to be the larva of the Noctuid moth, *Selenis suero* Cram., boring only for the purpose of pupation.

The host-plant, *Aeschynomene laxa* Gleason, related to the Indian shrub which supplies the material for solah topees, is a tall straggling suffruticose bush, with small purplish Papilionaceous flowers, finely pinnate mimosa-like leaves, and swollen pithy bases to the stems. There are numerous sticky glands on the thin, spindling leaf-bearing twigs, which branch off abruptly from the much stouter stem. At Kurasabai it grew plentifully in the open savannah, on the drying margins (widely inundated in the wet season) of a small pond, among grasses, sedges and coarse herbs, including *Sagittaria* sp., *Paspalum densum*, *Sacciolepis* sp., and *Scleria* sp.

The nearly full-fed caterpillars were found on the foliage, which they had very largely destroyed. The larva is of extraordinary appearance, with scattered long black hairs, and two long, fleshy, backwardly directed caudal processes. All the prepupae and pupae were found in borings in the main stem of the plant. This curious habit may probably be ascribed to the fact that the soil at the base of the plant lies under water for at least half the year. The upper inter-nodes of the main stem are hollow, though the central lumen is not wide enough to admit

the caterpillar, which is of considerable size. The original cavity is eaten into by the caterpillar and then smoothly enlarged, so that the prepupa, head upwards, fits in like a plug. The reduced anal processes are directed forward like the fork of a Collembollan, along the underside, and the long hairs, also somewhat shortened, are similarly flattened forwards. The pupa, always head upwards, lies just below the opening into the stem, which is completely covered with a transparent window, apparently of silk. In one or two cases the widening of the original cavity had weakened the stem so that it snapped and bent over, more or less exposing the pupa. The stems were nearly always already bored from top to bottom, and showed some reddish frass, but the central cavity was very little enlarged by this borer, an elongate weevil grub which was found at work actually in the swollen base only. Some of the *Selenis* pupae were in stems which had not been previously bored; so the pupation chambers certainly stand as the independent work of the full-fed caterpillar.

A striking feature was the heavy incidence of parasitism by a number of different insects. One pupa, broken at the top, contained three roundish elliptical Tachinid puparia, of which two had already yielded flies, while the other contained a stout *Alysia*-like Braconid (?) larva, completely filling it. This hyperparasite larva was unfortunately not reared. Numerous other parasitised *Selenis* pupae were found, and reared to a new species of Tachinid, *Prophryno myersi* Aldrich. Other pupae were parasitised by a species of *Spilochalcis*. One of the Prophryne puparia yielded a second hyperparasite, a small black *Chalcis* sp.

Every caterpillar found outside the stems, and still on the foliage, was parasitised by a *Euplectrus*, the naked larvae of which fed, in the usual manner, in a close group on the dorsum of the host. Most of the latter were, however, already dead and plastered to the twigs by a layer of loose, shining silken *Euplectrus* cocoons, evenly disposed beneath their dried skins. The infestation of *Aeschynomene* by *Selenis* was evidently in its concluding stages. With the further advance of the dry season, the pupae would remain in the dead dried stems, and emerge in the rains to attack the new young growth shooting from the then wet mud. The concentration of parasites in the final stages of an infestation is well known and easily explicable.

The parasites of *Selenis* may be summed up as follows :—

Primary on the larva—*Euplectrus* sp.

Primary on the pupa—*Prophryno myersi*, *Spilochalcis* sp.

Secondary, attacking the *Prophryne* puparia.—*Chalcis* sp., Undetermined Braconid.

I am indebted to the U.S. National Herbarium for determining the plant and to the Imperial Institute of Entomology (and Dr. J. M. Aldrich) for the naming of the moth and the Tachinid.

Some rare insects from Windsor Forest. By H. St. J. K. Donisthorpe.

On 8th May I took a specimen of *Diprion polytomum* Htg., when beating spruce in Windsor Forest. Only 2 other British specimens are known to me, both from the New Forest, and of these, 1 is in the British Museum.

On 5th May at the same locality I took *Aleochara discipennis* Muls. on cow-

dung. This species has only been recorded from the Isle of Sheppey (Comm. *J. J. Walker*) and the New Forest (Dr. *D. Sharp*) on sheep, and horse-dung, respectively.

On 30th May, 1929, and 31st May, 1934, I took a specimen of *Megapenthes lugens* whilst beating hawthorn in Windsor Forest.

A probable first record for Britain of *Brithys crini*. By J. A. C. Greenwood.

I have some specimens of a moth which as far as can be ascertained from existing records has not previously been taken in the British Isles. In October 1933 I found twenty-four larvae within a few yards of one another in a flower bed at Kew Gardens. They were fairly large and very conspicuous and were feeding on a low-growing plant, *Zephyranthes candida*, a white flower rather like a crocus and commonly used for edging at Kew. This plant has been growing in the bed for many years, having, I understand, originally come from the Argentine. I was quite unable to identify the larvae in spite of their unusual appearance and finally sent one to Mr. Riley of the British Museum. He stated that Mr. Tams and he were of the opinion that they were *Brithys pancratii* or *B. crini*. From the preserved specimens in the museum collections and the descriptions available certain identification was not possible. A further search did not reveal any more larvae, but on inquiry at the gardens I was told that they had previously been noticed by an under-gardener and sprayed with insecticide, apparently without the least effect. Two larvae were subsequently found by one of the staff but were not reared.

By the kindness of Sir Arthur Hill, the director, I was able to obtain supplies of *Zephyranthes* at frequent intervals from Kew, and Mr. C. N. Hawkins, who assisted me in endeavouring to rear some of the larvae, and I, tried them with various alternative plants, but we did not succeed in inducing them to more than nibble a daffodil bulb. In its native country *B. crini* feeds on *Pancratium maritimum* and plants of the orders Amaryllidaceae and Liliaceae.

Twenty of the larvae pupated, and as Mr. Hawkins and I were doubtful of the conditions required to rear them successfully it was decided to keep half the pupae at Kew, where they were housed in a glasshouse at a constant temperature of 60° F. with a moist atmosphere. These conditions were apparently suitable as nine moths emerged from the ten pupae on 27th and 28th March, 1934. I obtained a number of eggs from two females, but these were not fertile. Although several are still alive the pupae kept by Mr. Hawkins and myself at normal temperatures show no signs of emerging.

Having obtained imagines I submitted these to Mr. Tams for identification and he, having kindly examined the genitalia, is fairly certain that *B. pancratii* and *B. crini* are the same species, since he has so far been quite unable to discover any difference between those found at Kew and five specimens of *B. pancratii* and *B. crini* from different localities. *B. crini* was described about 150 years ago and *B. pancratii* a few years later.

It is difficult to suggest how the moth was introduced into this country. The authorities at Kew say that no plants from the localities where it is found have been recently introduced near the place in the gardens where the larvae were found, but the fact that all the specimens were so near together seems to indicate

the presence of a female. *B. pancratii* and *B. crini* have a wide range from the Mediterranean region to India and Java, but as it is not possible to localise this it becomes even more difficult to guess at the possible method of introduction.

(Since the above was written a male emerged on 10th June, 1934 (C. N. Hawkins), and a male and female on 13th June (J. A. C. G.).)

A ♂ *Leptidea sinapis* L., *in cop.* with a dead ♀. By Col. F. A. Labouchere.

When collecting in Sussex recently I saw what I took to be a pair of *L. sinapis* paired on a flower head. On further investigation, however, I discovered that the male was clasping the dead body of a female to which the right hind-wing was still attached.

I presume the female to have been attacked by a bird and the male to have flown off still clasping the remains of his mate.

African HESPERIIDAE and attacks by birds. By Professor Hale Carpenter.

The following specimens were exhibited from the Hope Collections, Oxford University Museum.

1. *Parnara detecta* Tr., captured 30 Oct., 1925, in S.W. Abyssinia by Mr. (now Sir) Arnold Hodson, at about 1900 feet elevation. The wings are somewhat rubbed, and on the right fore-wing are two V-marks directed backwards and outwards from the costa, one at about the centre of the costa being longer than the other nearer to the apex. The marks were at first considered to be such as might have been made by the beak of a bird, but when more closely scrutinised with a lens it was found that a doubt was suggested by the fact that the inner limb of the inner mark began on the edge of the sub-costal nerve, which was broken at that point. Anterior to this the costal margin of the wing was broadly rubbed, and it is possible that the nerve had been broken by a fold of the wing. This, however, does not account for the outer V-mark, but this being invisible on the under surface cannot be fairly claimed as a beak mark.

2. *Celaenorrhinus galenus* F. captured 16 April, 1925, by the same captor at Maji, S.W. Abyssinia. The hind-wing on each side has a small Λ-shaped notch, just internal to vein 2 on the left side, external to vein 2 on the right side. On the left wings, directed forwards, is an elongated triangular mark the apex of which is on the hind margin of the front wing, but the greater part on the hind-wing. Although the base of the triangle is not visible behind the middle of the hind-wing, its inner limb, if continued backwards, leads to the notch on the margin of the hind-wing. The Λ-mark is visible on the under surface of the hind-wing.

3. *Sarangesa eliminata* Holl., from Port Sudan, captured 3 March, 1912, by the late Dr. G. B. Longstaff. The right front wing bears an elongated rather narrow triangular mark extending forwards from the posterior margin and slightly outwards. The tip of the mark is slightly on the inner side, and between it and the main part of the mark is a length of about one millimetre on which no mark is visible. The wing has obviously been folded or crumpled when the beak was pushed across it from behind so that on expanding again it showed the mark in two parts. The mark is visible beneath. The right hind-wing bears a curiously shaped mark radiating in two directions from the centre of the wing, and equally

well shown on the under surface, which suggests that it also has been crumpled, but the mark cannot be considered as showing the accurate imprint of a beak so much as the result of pressure of a beak upon a wing folded on itself. The posterior end of one of the radiating marks leads to a notch in the hind-wing between veins two and three. The narrowness of the imprint on the anterior wing suggests the beak of a Bee-eater.

Incipient mimicry by a Californian form of the Nymphaline butterfly *Basilarchia weidemeyerii* Edw., of the *B. lorquini* Boisd., and *Adelpha californica* Butl., association. By Prof. E. B. Poulton.

The three male examples of *weidemeyerii nevadae*, exhibited to the meeting, were very kindly sent to me by my friend Commander C. M. Dammers of Riverside, California, who has helped me for many years in the further study of the fascinating western N. American diaposematic association between *A. californica* and *B. lorquini* of which a preliminary account was given in 1908, *Trans. ent. Soc. Lond.*, **1908** : 447, pl. xxv. The three specimens were taken 25 July, 1933, in the Mono Basin, Central California, by Dr. John A. Comstock. Two of them exhibit, over an area at the apex of the fore-wing upper surface and slightly larger in one specimen, an orange tint resembling but distinctly paler than that of the corresponding but much larger area in *B. lorquini*. The white upper-surface markings of these two specimens, but not of the third, also show a very slight approach towards the cream-colour of these markings in *lorquini* (see p. 56).

I was very anxious to learn whether this western form of *weidemeyerii* is a new species or a sub-species, as was rendered probable by the different degree of development of the orange area in two specimens and the fact that the third was indistinguishable from typical examples of the parent form in the Rocky Mountain region from Montana to Colorado. I therefore asked my kind friend Dr. Eltringham if he would make preparations of the male armature of all three specimens and compare them with those of *weidemeyerii*, prepared and figured by him in my paper 1914, *Proc. Acad. nat. Sci. Phila.*, **66** : 161, pl. V, fig. 2. This he did, and compared all three with the original preparations which were before him when the published figure was drawn, concluding quite definitely that so far as this criterion may be trusted, all were of the same species as the more eastern *weidemeyerii* and that there was not the slightest resemblance to the genitalia of *lorquini* (represented in fig. 1 of pl. V) such as we should expect to find if this Californian form were a hybrid between *lorquini* and *weidemeyerii*.

I am looking forward to the completion of a further study of the extremely interesting *A. californica–B. lorquini* association, based on the fine material so generously given me by Commander Dammers as well as on that in the British and Tring Museums; also on the material formerly in the Hill Museum, Witley, but recently a valued gift to the Hope Collection. Great additional interest is now supplied by the apparent incipient entrance into this association of the Californian race of *B. weidemeyerii*, as will be made clear by an inspection of pl. XXV of our 1908 *Transactions*. The first and last figures of this plate represent typical *weidemeyerii*, while the remaining figures are of species with an orange apical or subapical F.W. area, so that it is not difficult to appreciate the increased signifi-

cance and interest of this mimetic association, brought about by the change which appears to have now begun.

Since the meeting of 6th June, I have received an interesting account of this new race, written by Commander Dammers, after consultation with Dr. J. A. Comstock, to whom also I extend warm thanks for his kind help.

A little later, on 15 August, Commander Dammers posted to me a female *nevadae* of the form *fridayi* taken on the same day, 25th July, and in the same locality (the Mono Basin) as the three males, by Dr. J. A. Comstock. The butterfly, which arrived in perfect condition, is a wonderful mimic of *B. lorquini*, and thinking that it would be convenient to refer to the resemblance, and also to include Commander Dammers' valuable information, in the communication upon the three males, I have ventured to add this post-dated section.

E.B.P., 8 *October*, 1934.

The following account of the race *nevadae* was kindly sent to me, 12 August, 1934, by Commander Dammers :—

" Barnes and Benjamin described the Californian form of *Basilarchia weidemeyerii* as the race *nevadae*, in their ' Contributions to the Lepidopt. of N. America ' (**5** : 99, 1924). Mr. Jean Gunder, of Pasadena, California, described the ' hybrid ' as a ' transition form intermediate between *lorquini* and *nevadae*,' calling it *fridayi*, in the 1932, Canad. Ent., **64** : 284. He named it after Mr. Friday of Los Angeles, who was the first to capture specimens.

" Dr. J. A. Comstock published some further notes on these new specimens in Bull. S. Calif. Acad. Sci., **32**, Dec., 1933. Dr. Comstock collected both eggs and larvae in the district and sent me one larva which was the only one that came through to imago and was a true *Bas. weidemeyerii nevadae*.

" The type locality of *B. w. nevadae* is the Charleston Mts., South Nevada. It ranges through the Mono Basin in Central California and as far south as the Charleston Mts. How far north it extends we do not know. All the *fridayi* specimens have been taken in a very restricted area in the Mono Basin district. This is beyond my collecting area, being several hundreds of miles North of here."

In the course of the correspondence with my friend Commander Dammers I had expressed the opinion that *B. lorquini* stands apart from the other N. American Basilarchias, as appeared to be shown by Dr. Eltringham's preparations of genitalia referred to on p. 53.* Referring to this opinion, Commander Dammers wrote, in the letter quoted above :—

" I have now raised a quantity of *B. lorquini* and *B. obsoleta* through from egg to imago and one specimen of *B. weidemeyerii nevadae* Edw. The appearance of the larvae and pupae, and the habits of the former in all three species are quite indistinguishable, so much so that I did not take the trouble to paint pictures of *B. w. nevadae* but only remarked that they were the same as the other two. Some larvae of *lorquini*, however, exhibit a tendency to have more brown on them than the other forms." It is very interesting to learn that these three species, one of

* S. H. Scudder, in *Bull. Buffalo Soc. nat. Sci.*, **1875** : 233, separates *lorquini* from the genus *Basilarchia* and places it with *Adelpha californica* under *Limenitis* (p. 250).

which (*lorquini*) exhibits distinct differences in the male armature, should resemble each other so closely in the earlier stages.

The following paragraphs are copied from a letter, written 16 September, 1934, by Commander Dammers :—

" I am glad the specimen arrived in good order. It was the extreme case. Dr. Comstock quotes in Bull. S. Calif. Acad. Sci., **32,** Dec. 1933 : ' While this form is not constant as regards the degree of this [orange] coloring, and ranges all the way from a mere trace, to such an amount as almost to suggest *lorquini*, there is nevertheless one constant feature which separates them from true *lorquini*. This is the absence, on the under surface, of the usual red-brown suffusion of the secondaries. They are in fact, typical *nevadae* with the addition of the *lorquini* patch on the apices of fore-wings.'

" Realizing the importance of breeding them out I arranged with Dr. Comstock to get me a quantity of larvae from that district. It is a long journey and beyond my beat. He went up there especially and had no luck. Apparently the area is very restricted and I do not think there have been more than 20–30 specimens taken in all.

" I think this is the only record of an overlap—anyway Mono Basin is the only Californian locality for *B. weidemeyerii*.

" I might mention that I have one ♀ imago of *B. lorquini* I took near San Francisco that on the upper surface only is identical with the ♀ specimen I sent you on August 15, but underneath is true *B. lorquini*. It has the row of reddish-brown spots outside of the white central band on the upper surface of wings and is therefore *Bas. lorquini*, ab. *eavesii* Hy. Ed.

" I am just back from a most successful trip on the Mojave Desert and found *Papilio bairdii* Edw., and the forms *oregonia*, *brocei*, *hollandii* all flying together. I have a quantity of larvae and all are indistinguishable from the larvae of *Pap. zelicaon* Luc., and readily took to the food-plant of the latter."

My friend Mr. Riley has called my attention to the recent experience * of Mr. C. Brown who, with Mr. Creelman and his son, collected, 13–16 July, 1933, on the W. shores of Mono Lake. They took 130 *B. weidemeyerii nevadae* and 55 *fridayi* : also " a sprinkling of what can be termed straight *Bas. lorquini* Bdv." [I have since heard that three *lorquini* were taken.] He considers that " there is no doubt but that it is a perfect case of cross-breeding between these closely related, yet divergent groups." The three naturalists are to be congratulated on their success in obtaining so large a series of these most interesting forms. The proportion of females, especially among the *fridayi*, would be very welcome information.

Commander Dammers permits me to quote from a very interesting letter written by Dr. John A. Comstock, 4 Oct., 1934, stating that the var. *fridayi* and *B. w. nevadae* do not, so far as he is aware, occur together except " in the region of Mono Lake—a desert area in which oaks do not grow and in which therefore *Adelpha californica* is not found. If *fridayi* is a mimic it would therefore be a mimic of *lorquini*," which, as he writes, occurs in this district and flies with *fridayi*. " Furthermore, there is not a very constant association of the various races of *weidemeyeri* with *lorquini* throughout other ranges. *Weidemeyeri* is a poplar- and

* 1934, *Ent. News*, Phila., **45,** No. 8 : 205, 206.

willow-feeder and hence, in the semi-arid and desert regions, occurs at a lower elevation than does the oak-feeding *Adelpha*. There are many regions in our western states of California, Nevada and Arizona where the ranges of *Adelpha* and the *Basilarchias* somewhat overlap, yet in no other region except Mono Lake do we find this peculiar form, *fridayi*." The mimetic association between *fridayi* and *lorquini*, if, as I believe, it exists, is similar to that known to obtain between species in the same or closely related Danaine or Acraeine genera. In some of these instances mimetic species act also as the models for other species.

The wonderful upper-surface mimetic resemblance of this female specimen of *weidemeyerii nevadae* is not only brought about by the orange-brown at the fore-wing apex; the pale markings of both wings are cream-coloured like those of *lorquini* and not white like the parent form. Observing this in the female I was led to examine the three males more critically and then for the first time realised that the two with the incipient orange apex differed from the third without this development in the very faintly yellowish tinge of the pale markings (see p. 53). The third male exhibited the brilliant white of the more eastern *weidemeyerii*.

Another element in the resemblance to *lorquini* is the pale spot in the F.W. cell upper surface. In the female *fridayi* and two male *nevadae* this spot is quite distinct, although not large as in typical *lorquini*. In the third non-mimetic male it is represented by scattered scales. Thus the colour of the F.W. apex, the tint of the pale markings and the development of the F.W. cell spot, all appeared together in the two males as well as the female, in which also the first two elements in the mimetic approach were immensely emphasised.

It should be mentioned that among 5 ♂♂, 1 ♀ *weidemeyerii* from Colorado in the Hope Collection, the F.W. cell spot was only present in 2 ♂♂ and, in these, smaller than in the Mono Basin specimen which showed the least development of the three. The series of reddish spots beyond the outer border of the pale discal H.W. band, similar to those of *lorquini*, f. *eavesii*, is well developed in the ♀ and faint in one ♂ *nevadae*, but this is a feature which often appears in the more eastern *weidemeyerii*, especially frequently and especially strongly in the females.

In conclusion I wish again to express my warm thanks to my kind friends who have given me such great and unexpected pleasure in studying this new member of the western N. American *Adelpha–Basilarchia* association and in giving me the opportunity of introducing it to our Society.

Mimetic resemblance of a fly (*Baccha* sp.) to a Fossorial wasp (*Trypoxylon*) on Barra Colorado Island. By Prof. E. B. Poulton.

Prof. Poulton said that he had received a letter, written 17 April, 1934, from his friend Dr. J. G. Myers, calling attention to this interesting record :—

" I have just noticed that on p. 155 of Rau's ' Jungle Bees and Wasps of Barra Colorado Island ' is a good account of the mimicry of a *Trypoxylon* by a fly (*Baccha* sp.). Form, colour and behaviour were so exact as to deceive many times Rau, ' who has known *Trypoxylon* in the field for twenty years.' Later he says (p. 156), ' I feel certain that if the swivel-chair naturalists who criticise mimicry so adversely could see the living wings in action, they would at least encourage further inves-

tigation.' It is a pity more of the American entomologists, who are so sceptical about mimicry phenomena, do not go to the Tropics."

Prof. Poulton said that he, too, had noticed this interesting observation in a copy of the book given him by his old friend Prof. James Mark Baldwin; also certain other important notes which he hoped to bring before the Society in the future. Rau's book was warmly commended by another old friend, Prof. W. M. Wheeler, with whom he remembered delightful rambles near Chicago, in the year 1897.

On a Euploeine association on a small island near Santa Isabel in the Solomons; also a further observation on Euploeas attracted by dead leaves of Tournefortia. By R. A. Lever.

Prof. Poulton said he had received the following letter, written by Mr. Lever, 4 March, 1934, at Tulagi, Solomon Islands :—" I am sending a few more Euploeas and a Danaine which I collected last month when in Santa Isabel. They were taken on a very small coral island named Huleo off the southern coast of Santa Isabel. While there I had the good fortune to see a couple of Euploeas feeding on the recently dead, flaccid leaves of *Tournefortia*. Their proboscides were fully extended and they were actively engaged in feeding on the surface of the leaf."

Prof. Poulton exhibited examples of the 21 specimens—all males except the *Danaus*—sent by Mr. Lever, viz. 10 *Euploea* (*Salpinx*) *polymela* Godm. and Salv.; 3 *E.* (*Mestapra*) *fraudulenta* Butl.; 7 *E.* (*M.*) *nechos* Mathew. The single Danaine, a female, *D.* (*Salatura*) *mytilene* Feld., ssp. *decipiens*, Butl., was noted as "Flying with Euploeas." Mr. N. D. Riley had kindly helped in the determination of the Danaine and Mr. A. G. Gabriel with the Euploeines.

The observation upon the two Euploeas drinking from the surface of the dead *Tournefortia* leaves was of especial interest. Although this attraction for male Euploeas had been witnessed by several naturalists,* Mr. Lever's was, he believed, the first definite observation of their actual feeding and the use of the proboscis. There could be little doubt that the two Euploeas were males and it was extremely probable that they belonged to one or two of the three species sent by Mr. Lever from the same island.

***Papilio g. glaucus* L., mutilated and abandoned at Milwaukee, U.S.A. : the hind-wing "tails" as parasemes adapted to protect the vital parts.** By Miss E. A. Oehlenschlaeger.

Prof. Poulton exhibited the two male specimens of *Papilio g. glaucus* L., sent by his friend Miss Oehlenschlaeger, and communicated the following extracts from her letter of 1 Sept. 1933 :—

" I have just finished packing two specimens of the 'Tiger Swallowtail,' *Papilio glaucus*, which the Martins do not enjoy as food. One was staggering about

* 1890. *A Naturalist among the Head-hunters*, Lond., p. 94.—C. M. Woodford.
1926.—*Proc. ent. Soc. Lond.*, **1** : 35–7, 48.—Dr. Armstrong, Prof. P. A. Buxton, G. H. E. Hopkins, E. B. Poulton (comments, p. 48).
1927.—*Insects of Samoa*, &c., Brit. Mus. (Nat. Hist.), **3** (1), Lepidoptera, p. 16.—G. H. E. Hopkins.
1931.—*Proc. ent. Soc. Lond.*, **6** : 77–80.—Dr. Armstrong, Prof. P. A. Buxton, G. H. E. Hopkins, R. A. Lever, H. W. Simmonds, C. M. Woodford, E. B. Poulton (comments).

among the flowers round the house and thus attracted my attention. Part of the left hind-wing had been torn away, also the 'tail,' but I do not know what bird—if a bird was the culprit—was responsible. The other specimen I found, minus the head and thorax, on the table of our little cactus-house. The left wings had been much mutilated and many pieces scattered by the wind.

"One of my younger friends who is an entomologist of great promise told me of an interesting observation he made some years ago:—A 'Tiger Swallow-tail' had settled and folded its wings into an upright position, when a bird—he did not remember the kind, being more interested in insects—flashed down and snipped off the tails. The bird did not appreciate the flavor and flew away, but the butterfly was captured and provided food for thought. The young entomologist is still wondering whether the tail-like prolongation of the hind-wings of this particular species, or, for that matter, of all 'Swallow-tails,' is a contrivance adapted to protect the head."

Prof. Poulton said that it was of much interest that the theory of parasematic adaptation, as described in 1930, *Proc. ent. Soc. Lond.*, 5 : 16–7, should have independently arisen in the mind of a young naturalist as the result of the actual attack described by Miss Oehlenschlaeger.

Attacks by birds upon moths. By J. G. Myers.

Prof. Poulton communicated the following observations recorded by his friend Dr. Myers, and received with his letter of 3 May, 1934:—

"*Burnham Beeches*, 7.iv.28. There was a party of marsh tits—four or five. One dashed to an adjacent tree-trunk, seized very rapidly a small resting moth, flew back at once to its branch—right, left went the wings of the moth, and it was swallowed.

"*Mina Carlota, Santa Clara, Cuba*, 22.iii.34. A common lizard (*Anolis sagrae*) was seen with a large moth (*Mocis punctularis* Hübn.), not quite dead. The moth was carried by the dorsum of the thorax in such a position that the wings were helpless. It is a procryptic species which rests with its half-closed wings in the form of a triangle."

Further observations made in Singapore, upon Geckos and distasteful moths and upon a luminous Coleopterous, probably Rhagophthalmid, larva. By H. N. Ridley, F.R.S.

Prof. Poulton communicated the following notes extracted from a letter, written 20 May, 1934, by his friend Mr. Ridley:—

"Reading through my old diary I came across more notes on the Zygaenid (Chalcosiine) moth *Pintia sordida* Walk. and Geckos, which I had quite forgotten. They were made in Singapore some months later than those recorded on pp. 9, 10 of these *Proceedings*.

"12 *March*, 1910.—This evening one of the dark blue and white moths which come to light so often and are uneatable, settled on the table at which I was writing and a brown Gecko caught it by the hind-wings and body. . . . It held it in its mouth for some time but then let it drop. The moth soon recovered and went off, apparently quite unhurt. The Gecko turned away and kept putting its

tongue out as if licking its lips to get the taste out of its mouth. . . . The next evening I threw it another moth of the same kind; after looking at it for some time it seized it by the head and held it for about half a minute and then dropped it. The moth lay on its side with its wings folded over its back, and the Gecko ran away behind the paper-rack. Presently the moth got up and walked away all right.

" This Gecko was *Gecko monarchus*, which lived for a long time in the paper-rack on my table in the veranda and came out every night to eat moths, till one day it accidentally fell to the ground some 20 feet, and having 2 eggs in it, died at once. It is clear that these Geckos take the insects in their mouths gently at first, not crushing them and spit them out if they don't like the taste, so that the moth escapes quite unharmed. The Geckos normally of course feed in the dusk or at night in a wild state so that they could hardly see colour and I suppose must taste the nocturnal things gently first before they bite them up.

" I enclose a life-sized sketch, drawn June 25th, 1908, of the glow-worm which made the dog sneeze, as described on p. 10 of these *Proceedings*. It is rather a rough figure but, as often happened, some one came in and took me off before I could finish it. It has so many lights along its sides that it looks like a P. & O. steamer at night with the lights shining through the portholes.

" The following notes are recorded in my diary for June 25, 1908 :—

" ' Last night I caught a common glow-worm on the path by my house (in the Botanic Gardens) and make the following notes on it. It is active and runs fast at night, coiling up and emitting a musky scent when touched. During the day it remains coiled up and quite quiet. Its lights are arranged as follows :—

Segment 1 : after the head. Two light spots very small in centre of the back; one on leg near the spiracle on each side.
,, 2 : 1 in centre; 1 lateral.
,, 3 : none central; 1 lateral.
,, 4 to 8 : 1 central; one near each spiracle.
,, 9 : none central; one near each spiracle.
,, 10 : one central; 2 to each spiracle.
,, 11 : none central; 1 to each spiracle.'

" I don't know what these glow-worms eat. There were no snails in the gardens except at one spot and there not enough to supply the numbers of glow-worms which were scattered about all over the gardens."

Prof. Poulton, referring to Mr. Ridley's words on the Chalcosiine moths uninjured by the Gecko's attack, said that the toughness and flexibility of these and so many other distasteful insects, together with their great tenacity of life, are of immense importance in promoting recovery from experimental tasting. With reference to Mr. Ridley's account of the luminous larva and his sketch, exhibited to the meeting, his friend Dr. K. G. Blair had written the following note :—

This drawing and the notes appear to refer to a larva, belonging to a genus undetermined in the British Museum, which I consider to be probably a Rhagoph-

thalmid, possibly *Diplocladon*. Males of *D. hasselti* Gorh. were sent to the Museum by Mr. H. N. Ridley, but nothing appears to be known of the female of this genus and it is possible that we have here a case of paedogenesis and that these larvae become sexually mature without ever reaching an adult stage.

In the dried larva it is impossible to recognise definitely the luminous organs described by Mr. Ridley, but in an example from Perak (Sharp Coll.) there is a well-marked light dorsal line and the sides are also light, suggesting a distribution of luminosity from deep-seated centres that would agree well with his description. There is further a large waxy-looking plate on the ventral surface of each abdominal segment from 2nd to 8th which I should expect to form the principal luminous organ, although no mention of them is made by Mr. Ridley. The description of an evidently allied larva may be found in *Trans. ent. Soc. Lond.*, **1865** : *Proc.* 101.—K.G.B.

A fine Nemopterid from the Belgian Congo.

Prof. Poulton exhibited a female *Nemopistha imperatrix* Westw., captured by his friend Miss Vinall at Bongandanga, Basankusu, " fluttering round the lamp on 10 March, 1934." The species—evidently rare in this locality, for Miss Vinall had written that the specimen was unique in her experience—had been kindly determined by his friend Mr. D. E. Kimmins.

A living example of Spiral Segmentation in the larva of *Lithophane* (*Xylina*) *socia* Rott ; (*petrificata* F.). By C. N. Hawkins.

A larva, bred by me from one of about 600 ova, is a good specimen of left-handed spiral segmentation in the 1st, 2nd and 3rd abdominal somites. The ova were laid by a moth taken on 5th April last, by Mr. P. Bainbrigge Fletcher, at Fritham in the New Forest. Except for the fact that all setae are present, and allowing for the difference in the pattern and segments involved, it is similar to the specimen of *Amathes* (*Orthosia*) *macilenta* Hb., described by myself in 1933 *Transactions*, **81** : 225, pl. xx, fig. 4. Unfortunately I cannot say whether there were any other abnormal specimens in the brood, as most of the ova, or young larvae, were distributed amongst friends. So far as I have been able to ascertain, however, this was the only one to show an abnormality. The ova were laid in chip boxes (when sufficient were laid in one box the female was placed in another), and for convenience the boxes were cut up and the pieces with ova upon them placed in glass-topped metal boxes for hatching. In cutting up the boxes some few ova were completely destroyed and it is possible some were merely injured. Obviously the facts are not sufficiently well known to enable any conclusions to be drawn, but it seems worth while to put the case on record.

Dr. W. H. Thorpe gave a résumé of his paper on ' the Biology of *Pantophthalmus tabaninus* ' and illustrated his remarks with the epidiascope.

Paper.

The following paper was read :—

" The biology of Scottish Psyllidae," by K. B. Lal.

Wednesday, 3rd October, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

Election of Fellows.

The following were elected Fellows of the Society :—Lieut.-Col. F. M. Bailey, Egmere, Walsingham, Norfolk; Frederick Thomas Baker, City and County Museum, Lincoln; J. Marshall, Empire Cotton Growing Corporation, Cotton Experiment Station, Barberton, Transvaal, S. Africa; Frank Stewart Parsons, Empire Cotton Growing Corporation, Cotton Experiment Station, Barberton, Transvaal, S. Africa.

Obituary.

The death of the Rev. W. F. Johnson, elected a Fellow in 1889 and a Special Life Fellow in 1923, and of Mr. C. B. Holman-Hunt, elected a Fellow in 1898, was announced.

Exhibits.

The following communications were then made to the meeting :—

A Drosophilid fly milking an *Orthezia*. By Dr. J. G. Myers.

(Communicated by the Secretary.)

On the 11th January, 1929, at St. Augustine, Trinidad, I found a very heavy infestation of a small *Orthezia*,* festooning the edges of the thick fleshy leaves of a *Euphorbia ligularia* hedge. Odd females at intervals, or close together, and young of all instars, in places formed a continuous white margin to the leaf. The lower part of the hedge was black with fumagine growing on honey-dew which could have come only from the *Orthezia*, since no other Homoptera were present in sufficient numbers. Numerous flies—Sarcophagids, Tachinids, Conopids and Ortalids—and Hymenoptera—male Mutillids, some Vespids, Pompilids, Ichneumonids and Chalcids—were attracted to the honey-dew. The larvae of several species of ladybirds were probably feeding on the young Coccids. Certainly a small Hemerobiid larva was, for it was covered densely with a great bundle of white skins. Literally hundreds of male *Orthezia* with very long tail-filaments were flying up and down before the infested leaves, or resting on them. Copulation was not observed.

The most interesting member of this assembly was, however, a small Drosphilid fly, either belonging to the genus *Drosophila* or very closely related to it. It hovered in some numbers round the leaves; now and then one would settle, usually just near a large female *Orthezia*, stay immobile for a few seconds and then spring upon the back of the Coccid or on its waxy caudal appendage. It next seemed to take a firm grip of wax and leaf, just near the end of the Coccid's actual abdomen, with its second and third pairs of legs, while the first were held in the air, and then brought down on the back of the Coccid, where they played with a curious lateral motion which I can compare only with the movements of a very lively piano-player, executing a complicated piece of music. The fly was so engrossed in

* I have been unable to obtain a determination of this Coccid.—J.G.M.

this task that I was able to use a hand-lens to observe its movements. The playing went faster and more furious, the fly gave what seemed an impatient flick of its wings, but continued the titillation. Suddenly a turbid-looking droplet appeared at the anus of the Coccid, the fly pushed out a fleshy proboscis and sucked it up, and then resumed its playing. It was rewarded, after a similar lapse of time (several minutes) by another, but smaller droplet. I then caught the fly. Six flies were actually observed in this activity, while a seventh was sucking drops of honey-dew from a small spider's web just below a large Coccid.

The white waxy " tail " (the ovisac) of the *Orthezia* may be as much as 6 mm. long, very thick and solid, minutely longitudinally ridged. The body of the adult female is about 2·4 mm., giving a total length of 8·4 mm. The shorter tails are straight, but with added age and length they curve, with a dorsal concavity. The anus is just at the apex of the abdomen, and thus at the base of the " tail," and it opens dorsally at the beginning of a deepish longitudinal groove, extending down the whole dorsal surface of the ovisac, and probably conducting away the honey-dew which is not sucked up by guests. The turbidity of the drop seemed to me to be due to a thin coating of the waxy powder. The substance of the ovisac, however, is not built up by the deposition of such films, but by the product of special glands which open on the abdomen.

Kannan, writing of *Orthezia insignis*, remarks that it is not much attended by ants, and the " honey-dew is more of a solid nature and little in quantity." (*Report Proc. 3rd Ent. Mtg., Pusa*, 1919, 3 : 857.)

Aggressive parasitism of a millipede by a Phorid. By Dr. J. G. Myers.

(Communicated by the Secretary.)

On a forest path at Mt. St. Benedict, Trinidad, at 5.30 in the evening of 9th December, 1928, I found a huge, smooth, black Julid millipede writhing frantically, much like a disturbed *Typhlops*. The writhings and contortions sometimes threw it completely over, when the paler legs, in close rows, gave the appearance of a pale reptile belly. On closer examination my wife and I found a Phorid fly, *Megaselia juli* * Brues, dashing round it, jumping upon it, and being thrown off by the victim's violent lashings. When we took the latter the Phorid seized the opportunity to spring upon its head, where it remained as we put both into a box. From then until 9.30, when we left it—a period of four hours—the fight went on, with amazing energy on both sides. When we turned the glass-bottomed box down so that the contents were in darkness, activity was apparently unabated, for we could hear the millipede lashing round as furiously as ever. The fly was constantly on the move, with short runs, hops and flights, springing upon the back of the millipede, and running towards the head, leaping off again to avoid, just in time, a crush from the hard, massive coils. Whenever it approached the victim's head its ovipositor (very long) was extended and carried thus for some time. The millipede, for its part, as soon as it felt the fly on its back, coiled and uncoiled with great force and rapidity, at the same time turning that part of its body near the fly sideways, and then crashing it against the adjacent part of the coil. Time and again it looked as though it were trying to crush the fly between the coils.

* Kindly determined by Professor C. T. Brues.

There was decidedly no mere undirected coiling or uncoiling, but a definite repetition of movements, made with extreme force, tending to bring the place where the fly sat into violent contact with the armoured dorsal part of the next coil, but the fly always skipped away in time, and, throughout these manœuvres, managed always to return a little nearer the head, which it sometimes reached, only to be dislodged before we could see that it had accomplished its purpose. Finally the millipede would rear up on a few of its posterior segments and dash its whole body from side to side, turn squirmingly over while two-thirds of its length was in the air, and repeat this with such frantic energy that the box appeared filled with writhing coils and it seemed inevitable that the fly would be crushed. As soon, however, as the millipede floundered more or less flat again, there, on or near its head, was the fly. Always the head was the goal.

Next morning, at 6.30, both seemed somewhat tired. The fly occasionally sprang upon the millipede, was dislodged by a few squirms, and remained quiet for a time. At 7.30 the fight was still proceeding, but very slowly. At 12, when we returned, the Phorid was dead upon the floor, with one wing missing. The millipede was kept alive, supplied with damp leaves, for several days. On the 15th, when we returned from two days' absence, it was dead and already falling to pieces.

A second specimen was found on the same forest path at 5.10 p.m. on the 18th December, writhing furiously, with at least four Phorids attacking it. One was boxed with the host, and the others as they ran over the spot where it had been. One of the flies carried the long ovipositor extended as it ran. We put two in the box with the millipede and left them for the night. Whenever we observed them the fight continued, but less strenuously than in the first case. The next morning one of the flies was dead and the other very weak. Both were removed and one of the separate Phorids put in its place. By the evening (6 p.m.) this was dead also, having tried to oviposit in the still writhing millipede several times during the day. The millipede was dead also, and next day was a seething mass of small Phorid maggots. The head of the host, with the anterior ten segments, had broken off, and the interior seemed packed with maggots. On the 22nd all had pupated, and on the 4th of January the first fly emerged.

On the 25th September, 1930, a third specimen of the same Julid was found at 5 in the evening, on the same forest track, squirming under the attack of at least five Phorids. Two of the flies escaped me, returned to the spot where the millipede had rested, and continued to quarter the ground there, with persistent dog-like regularity.

It is under wet-season conditions that this millipede emerges from its retreat and crawls across the damp path. Whether it does so because it is already sick we do not know, but the case certainly seems one of primary parasitism. Senior-White, however, records a Phorid which appeared to oviposit in Limacodid larvae just before they die from some other cause. (1920, *Spolia Zeylanica*, **11** : 299–302, 1 pl.)

Some rare Coleoptera from Britain. By H. St. J. K. Donisthorpe.

On 27th August, 1934, Miss I. Kirk took a specimen of a Longicorn in her room at 52, Oakhill-road, East Putney. Despite repeated attempts neither I nor Dr. Blair and Mr. G. E. Bryant have been able to identify it.

Hypophloeus fraxini, which I took in great numbers in August, 1934, was hitherto regarded as a great rarity. It was taken first in Britain by Sir T. Hudson Beare and myself in Forest of Dean in August, 1922; I next took one specimen at Bagshot in November, 1931. On each occasion it was found in the burrows of species of *Ips*.

An unusual form of *Nymphalis io*. By J. A. C. Greenwood.

On the 27th July, 1934, a specimen of *N. io* was taken when it flew into a drawing-room at Petersfield, Hampshire. The eye-markings are almost completely obliterated on all four wings, only a small light fleck remaining. A very large proportion of both fore- and hind-wings is thickly suffused with black and the remainder is a tawny red, while the underside is also considerably darker than normal. The form is an extreme and striking one, its appearance suggesting a heavy sprinkling of soot. I have not heard of any similar specimens being taken in the locality this summer.

***Acraea rahira* Boisd. from Uganda.** By Prof. G. D. Hale Carpenter.

The distribution of this species is given in Eltringham's monograph as Angola, Damaraland, Cape Colony, Natal, Transvaal, Mashonaland, N.E. and N.W. Rhodesia, and Portuguese E. Africa. The Hope Department, Oxford University Museum has received through the kindness of Mr. G. L. R. Hancock, F.R.E.S., specimens from Uganda as follows :—Lira, in the Lango district East of the Nile, three males 3.vii.31; River Kizibu, Bulemezi, Buganda, South of L. Kioga and west of the Nile, May 1933 one male; Kakumiro in Bunyoro about 15 miles north and slightly west of Mubendi, one female, 16.x.33. These localities are in the low-lying swampy parts of Uganda, just such localities as might be expected for this well-known swamp butterfly. Although I have spent many years in Uganda I have never found *Acraea rahira* there, and first saw it in Bechuanaland. There are specimens in the National Collection from Lake Mohasi, in Belgian Ruanda east of Lake Kivu, but that locality is apparently an isolated one: I traversed that country during the War but did not see *rahira*. Through the kindness of Mr. F. W. Goodson I am informed that there are no specimens in the Tring museum from localities north of north-east Rhodesia. The records for Uganda therefore greatly extend knowledge of the range of this species.

***Charaxes pythodoris pallida*—a correction.** By Prof. Hale Carpenter.

In the description of *C. p. pallida* on p. 12 of this volume I omitted to state that the type specimen is a male.

Observations made in 1934 on butterflies and their enemies in South-Eastern France. By J. A. Simes.

While in South-Eastern France during the last week in July and the first two weeks in August, 1934, I made a number of observations which appear to be of bionomic interest.

I worked in two centres, namely Digne in the Basses Alpes, and Agay in the Dept. of Var. Digne is well known as one of the most famous resorts in Europe

for butterfly hunters. The whole district is on limestone, and is cut up into a series of hot valleys, some of the latter being mere sword-cuts in the hills. Insects are generally abundant there, and I have never seen a greater profusion than was to be found at the time of my visit. The other locality, Agay, is situated in the volcanic Estérel (between San Raphael and Cannes). The red porphyry hills are low and densely wooded. The flora is not widely different from that of the Riviera generally; but there are numbers of fine cork-oaks, and, a little way up the hill-sides, quantities of tree heath, arbutus, cistus and very thorny Leguminosae.

1. *Female butterflies drinking at water-courses.*—Drinking habits in butterflies are commonly believed to be almost, if not quite, restricted to the males; and the females are not supposed to frequent water-courses. This idea must be abandoned. During the period July 26–Aug. 3, 1934, females of the following Satyrine species were observed at Digne drinking in some numbers :—*Kanetisa cordula* Fab., *Eumenis semele* Linn., *E. fidia* Linn., *Aulocera proserpina* [Schiff.], *Hipparchia fagi* Scop., *Minois dryas* Scop., *Satyrus galathea* Linn., *Coenonympha dorus* Esp., and *Maniola tithonus* L. In addition, the Pierine *Aporia crataegi* L. (one example only) was observed.

The desire for water seems to increase as the female insects become old and worn. The female of *Aporia crataegi* referred to above was the only example of the species met with—evidently the last survivor of a worn-out brood. We saw it morning after morning for three or four days, always drinking at approximately the same spot. Then one morning it was missing and it was not until some hours later that we found its lifeless body floating in a pool at the side of the stream.

Even in the Lycaenidae females occasionally go down to the water. Friends of mine who were at Gavarnie, Hautes Pyrenées, in July last, inform me that they saw several females of *Plebeius argus* L., drinking at water-courses. In July 1924 when collecting at Nans, Var, France, I found that the males of the Theclid butterfly *Laeosopis roboris* Esp., did not come down to the water but three females were observed there. I should add that although there are streams in the volcanic tract of the Estérels we never saw any butterflies of either sex drinking at them.

2. *Butterflies attracted by human perspiration : Digne, Basses Alpes, July* 26 : *Aug.* 3, 1934.—The following species settled upon our clothing, nets, haversacks, or boots. All were males except where otherwise stated :—Satyridae : *Hipparchia fagi* Scop., *Aulocera proserpina* [Schiff.], *Eumenis semele* Linn., *E. arethusa* Esp. (this was so persistent that we called it the "Saucy Arethusa"), *Kanetisa cordula* Fab., *Minois dryas* Scop., *Maniola tithonus* L. (females only), *Coenonympha dorus* Esp. Nymphalidae : *Polygonia c-album* L., *Limenitis camilla* L. Lycaenidae : *Lysandra coridon* Poda. Hesperidae : *Pyrgus alveus* Hb., *Hesperia comma* L., *Ochlodes venata alexandra*, Hemming, 1934.

After we had rested for about 20 minutes, and had thus cooled down, the interest waned. One day I tramped about half a mile along a stony track up a dry gorge. On retracing my steps I noted several Satyrid butterflies settled on the track in spots where my feet had trodden. They remained a very short time, however, and did not return. The attraction had clearly disappeared.

Mr. Collenette has suggested that when butterflies are found drinking, the real attraction may always be connected with some animal excretion—urinary or faecal. My experience seems to negative this view. All the species enumerated above, as well as many others, were found drinking in places where there could not possibly have been any human or animal contamination.

3. *Charaxes jasius* L.—*resting habit.*—Observation on several examples of *Charaxes jasius* L. in the Estérels convinces me that the species normally rests high up in the cork-oaks where the corky bark remains unstripped and there is a considerable growth of lichen. I saw several at different times take up their position in a deep furrow of the cork bark some 18–20 feet from the ground.

Various Satyrid butterflies, notably *Aulocera proserpina* [Schiff.], *Hipparchia fagi* Scop. and *Eumenis semele* L., are fond of roosting in precisely the same situation. Both the Satyrids and *C. jasius* are well protected in this position by their underside tones harmonising with the cork bark, though the actual markings and general arrangement of them are widely different in the above Satyrids and *Charaxes*.

4. *Butterflies attacked by wasps.*—Certain butterflies habitually drank only from damp moss on stones in the bed of the stream. The most notable examples of this preference were *Lycaenopsis argiolus* L., *Leptidea sinapis* L., and *L. duponcheli* Stgr. The underside coloration of these species made them most conspicuous objects on the moss and the common wasp (*Vespa germanica*) was making the most of the opportunity thus afforded. While lunching beside the stream I saw wasps carry off several examples of *L. argiolus*: and I also saw a wasp devouring the moth *Lithosia griseola* Hb. In each case the Lepidopteron was carried away entire.

5. *Bug attacking Zygaenid moth: Digne, July* 1934.—A Reduviid bug, *Rhinocoris cuspidatus* Ribaut, ♀, was found devouring a *Zygaena fausta* L., ♀. This moth belongs to a group with "warning" colours and as such is protected by being relatively unpalatable. Its immunity from attack, however, is clearly only relative; and the observation confirms those recorded by others who have found that many Hemiptera are especially adapted to prey upon distasteful conspicuous insects. The general coloration of this bug was distinctly similar to that of the moth.

6. *Mantis devouring Papilionid larva.*—On Aug. 6, 1934, in the Estérel Mts. I saw a mantis devouring a large larva of *Iphidicles podalirius* L. Two days later I had just marked down three larvae of the same species when a mantis flew on to a twig on which one of the larvae was resting and proceeded towards it. I took the larvae and the mantis flew away.

I caught the first mentioned mantis and one day when I was short of other food for it I gave it a larva of *Papilio machaon* L. The mantis would have nothing to do with this larva although it was left in the box for several days. It is clear, I think, that the secretion in the prothoracic glands of the larva of *Papilio machaon* —probably also the same is true of the other European species of *Papilio* which

feed on Umbelliferae, viz. *hospiton* Géné and *alexanor* Esp.—affords a protection against this predacious insect.

7. *Thomisid spiders capturing butterflies: Digne, July* 26–*Aug.* 3, 1934.—"Crab"-spiders concealed in flower-heads were very numerous at Digne, and I saw many examples of butterflies caught and killed by them. I have brought back in some instances (marked *) the spider and the victim, exhibited to the meeting. The victims noted were :—

**Colias hyale* L., ♀, on *Eupatorium cannabinum.*
Maniola lycaon Rott., ♀ do.
**Maniola tithonus*, ♀ do.
Argynnis daphne [Schiff.], ♀ do.
Coenonympha dorus (both sexes) on a *Mentha* sp.
**Iphidicles podalirius*, ♂, on lavender.

In the case of *I. podalirius*, a fine fresh insect, we saw the whole tragedy. Alighting on the flower-head, the butterfly was clearly in difficulties at once. In a moment it was dangling from an invisible thread about a foot below the flower. My son climbed up the rocks to the plant, arriving there in little more than two minutes after the butterfly had alighted. He found a crab-spider on the butterfly, and though he released the latter at once it proved to be dead. Both butterfly and spider were taken. Dr. A. R. Jackson, who has kindly examined the spiders, informs me that they are certainly THOMISIDAE, but that it is impossible to make any closer determination in dried specimens.

Protective resemblances of Acridians (Orthoptera), etc., observed in the South of France.—At Digne in the Basses Alpes (July 26–Aug. 3, 1934) and at Agay in the Estérel Mts. (Aug. 5–11, 1934) I collected grasshoppers which were tinted like the prevailing rock. The specimens taken comprise both blue- and red-winged species in both areas. These grasshoppers when disturbed did not alight on plants or shrubs but practically always on rock or soil where their colour protected them. Four grasshoppers from the grey limestone rocks at Digne have been identified by Mr. Uvarov as *Oedipoda germanica* Latr. (Charp.), ♂♂♀, and *Sphingonotus* sp., ♀. Five insects from the red rocks at Agay belong to the three species *Calliptamus italicus* L., ♀, *Oedipoda germanica*, ♀, and *O. coerulescens* L., ♀.

Among the stubbles in the Estérels I found quite another form, namely *Oedaleus decorus* Germ., ♀. Rain had fallen and the yellow stubbles had a dappling of green where fresh herbage was appearing amongst the yellow haulm of the wheat. The grasshopper found in these stubbles was tinted green and yellow and was thus wonderfully protected.

Yet another form—*Psophus stridulus* L., ♂♂, was found at an elevation of about 5000 ft. on the Cheval Blanc, Basses Alpes. This insect was almost entirely black, there being only a slight mottling of greenish-yellow on the legs and sides. I observed only two examples (which I took) and I am not able to assert positively that they are specially protected by their coloration. It is significant, however, that the prevailing rock is of a slaty colour; that the grass is green only at the top, and blackish below; and that there was much dead wood (black) lying about.

The two specimens taken flew several times before capture and always alighted in the dead part of the herbage which was of a blackish tint.

While on the subject of protective resemblance I should like to refer to the well-known habit of the Chrysididae (Hymenoptera) of feigning death when touched. A species observed at Digne bore, when in this attitude, a marked resemblance—which may be only a coincidence—to the berry of a shrub which grew in that locality. I exhibit two examples of the species which I took at Digne on the flower-heads of *Eupatorium cannabinum*. Both feigned death in the net, assuming a most curious posture. The insects were curled up into a ball, resting on the dorsal surface of the thorax, with the wings closely folded together. In this position the red area on the abdomen was of course uppermost and looked like the dome of the berry. On both occasions when I first inspected the net I thought I had missed the insect and secured only a berry. The species has been identified as *Stilbum cyanurum* Forst., var. *nobile* Sulz., ♂♂.

It should be added that the Acridians, Chrysids, Thomisid spiders and victims, and Reduviid bug with its victim, referred to in the foregoing notes are now in the Hope Department of the Oxford University Museum.

I am indebted to Professor Poulton for much help in the interpretation of my observations and in the identification of many species. In the latter task he informs me that kind assistance was rendered by Messrs. N. D. Riley, B. P. Uvarov, W. H. T. Tams, W. E. China, and R. B. Benson; and I have to thank each of these gentlemen for his aid.

Swallows capturing butterflies on the wing, and feeding their young on Lepidoptera; Pentatomid bugs swallowed by Coots. By Mrs. M. D. Brindley.

(Communicated by Prof. Poulton.)

During a 4-weeks visit to Norfolk last summer, I noticed 3 instances of birds taking Lepidoptera.

(1) *Waxham, near Palling: August 29th.*—A cold wet day. I saw a swallow swoop at twice, and the second time catch, a butterfly, which I am pretty certain was *Pararge megera* Linn., though it is just possible it was a Meadow Brown which was also common in the place. The bird simply took the butterfly straight off, apparently swallowing wings and all. Some Cambridge friends of ours have a bungalow close to where we were staying at Waxham, and Mr. T. Wyatt, a keen observer of birds, tells me that earlier in the summer they had two swallows' nests on their verandah and were able to watch the young fed at close quarters. He says that butterflies and moths were brought quite commonly and given to the young, but he was never able to determine the species, as the insects, wings and all, were crammed into the fledglings' throats.

(2) *September 10th.*—I saw a swallow pursue and catch a small moth. I think it was *Plusia gamma* Linn., which was common thereabouts but of course could not be absolutely sure of the species.

(3) *September 2nd.*—I saw a Greater Whitethroat twice chase a small brown butterfly. The bird missed it and I gave chase—unsuccessfully, as I had no net

at the time. I think it was *Hesperia sylvanus* (*Ochlodes venata septentrionalis* Verity), as it flew quickly like a Skipper.

September 6th.—I tried feeding some semi-tame Coots on Hickling Broad, 5 miles from Waxham, with live individuals of the big Pentatomid bug *Piezodorus lituratus*. The experiments were not very successful, as it was windy weather and difficult to get the Hemiptera into the birds' range, and when the weather moderated next day, I could not renew the supply of bugs; but in the two (out of 6 possible) cases in which the bird did take up a floating bug, it swallowed it all right but followed up by shaking and washing its bill in the water for a minute or two—in a way which I, and probably Prof. Poulton also, would call "distastefully" but which McAtee ignores. The other four insects were blown into the reeds and one could not see exactly what happened.

Sparrows feeding their young on the "Cuckoo spit" (Homoptera, CERCOPIDAE). By Mrs. M. D. BRINDLEY.

(Communicated by Prof. Poulton.)

I do not know whether other Fellows have seen a note in the 1st Report on Zoology of the 1933–34 "Ann. Rep. N. Staffs. Field Club," **68 : 125**, by F. Fincher, as follows :—"*House Sparrow.* Several seen on June 20th, 1933, feeding young on frog-hoppers.* They deliberately pecked them out of the 'cuckoo spit' and took a good beakful on each occasion." Our garden is swarming with sparrows and frog-hoppers (and most other pests) but I have never seen any birds attack the "cuckoo spit."

These attacks being apparently unusual or at any rate rarely seen, I wrote to Mr. Fincher who kindly supplied the following details :—

"The incident to which you refer took place at Great Bridge, Staffs, in a small garden which had been allowed to run wild, and was overgrown with Rosebay Willow Herb. I was standing by a window looking into the garden and was thus able to watch the whole affair at about 3 or 4 yards' range without disturbing the birds. The following notes are exactly as I jotted them down at the time.

"'This morning (June 20th, 1933) I watched at very close quarters with field-glasses several House Sparrows pecking away the froth or cuckoo spit with which some of the Willow Herb was infested. During a lull in the proceedings I went out to investigate and as I could see some of the immature frog-hoppers still on the plant I thought at first it was only the froth they were after. Further observation showed, however, that the insects themselves were the objective, as I saw one bird in particular pecking up the small green frog-hoppers which must have been very common from the number it collected in one spot. All that I saw caught were fed to young birds waiting on a nearby branch.'

"The above is the only observation of the kind that I have noticed."

Prof. Poulton said that Mr. Fincher's observations were extremely interesting because they helped us to understand how some new habit may arise and spread. He had often wondered whether Mr. A. H. Hamm's observation on sparrows open-

* Evidently the Homopterous insect *Philaenus spumarius* Fall. *nec* L., which Mr. W. E. China tells me is now known as *P. leucophthalmus* L. (CERCOPIDAE); *spumarius* L. being an *Aphrophora* and synonymous with *A. alni* Fall.

ing the cocoons of the " Lackey Moth " (*Malacosoma neustria* Linn.), in his Oxford garden, by pecking through the leaf and thinnest part of the silken wall (1902, *Proc. ent. Soc. Lond.*, **1902** : xv), had been witnessed in other localities. Also the late Mr. W. Holland's record of the means by which starlings cleared the larvae of *Monima populeti* Treitsch., from *Populus tremula* (1890, *Ent. Mon. Mag.*, **26** : 216). It was probable that—in times of food scarcity, or of unusual increase in the numbers of the enemy or of some insect or other animal rarely or never previously attacked by it, or by a combination of these conditions—the use of new sources of food-supply and the employment of new methods for obtaining it, would, when once initiated, spread through a locality or country, and might finally, by the overlap of generations in time and of communities in space, become, without the help of hereditary transmission, part of the characteristic behaviour of the species. By these means it was perhaps possible to explain the origin of such extraordinary behaviour as that of the African Honey Guide (*Indicator*) which directs the traveller to a wild bees' nest and is repaid by feeding on the scattered larvae.

Attacks by birds on British Lepidoptera. By Prof. E. B. Poulton.

The following interesting records and/or specimens have been kindly sent to me during the past season.

Unsuccessful attempts by a Robin to remove the wings of Aglais urticae (L.).—These interesting observations were made by Mr. F. B. Welch, who wrote :—" Yesterday afternoon (28 Sept., 1934) I noticed several *A. urticae* busy on a plant of *Aster amellus* in my garden at Charlton Kings, Glos. A robin living nearby arrived and seized one butterfly, and flew off to the foot of a neighbouring fence where he tried to tear off the wings preparatory to eating it. Eventually he left the insect which fluttered about in bad condition. The robin then captured 2 other *urticae* in quick succession but failed to remove their wings and abandoned the butterflies as he had the first."

Evidence of bird's attack, on the wings of A. urticae.—Dr. J. G. Myers wrote on 23 May, 1934 :—" Here is one more case of a bird attacking a butterfly in England. 20.ix.26, Ashen, Essex. Saw a Small Tortoiseshell with a semi-triangular peck out of the conjoined front and hind-wing of one side. It had evidently been seized by a bird when the wings were outstretched."

Similar evidence on the wings of Pararge aegeria (L.).—My grandson Christopher Poulton of Rugby School took a male " Speckled Wood," 31 Aug. 1934, in the garden of St. Helens Cottage, St. Helens, I.W. Both fore-wings bear extensive injuries in the same area and roughly symmetrical, the hind-wings much smaller but otherwise similar injuries. This species was commoner than I have ever seen it before, and ranged more frequently and widely into open fields, etc.

Repeated but futile attempts of a Whitethroat to capture a white Pierine butterfly, probably P. rapae (L.).—The President has written, recording three determined attempts witnessed by him about 1.0 p.m., 26 Aug., 1934, at Birchington Kent.

Flying moth taken by Robin.—Mrs. K. J. Grant has told me that she observed the capture of a small whitish moth, probably a Geometrid, about 9.0 a.m., in May 1934, at Wheathampstead, Herts.

The late Mr. T. A. Coward's observation of a Skylark capturing the Gold-tail moth (Porthesia similis Fuess).—On receiving a copy of my note * in our 1931 (1932) *Proceedings* (6 : 90), Mr. Coward replied on 2 Jan. 1932 :—

" Thank you for your courtesy in sending me the reference, which does not, however, require alteration : may I add, your wisdom too, for later experiences may cause anyone to modify his opinion ?

" The observation was made at Rostherne, Cheshire, on July 6th, 1912, when I was with Prof. Tattersall—working at the plankton of the mere. This is part of my note, which may interest you :—

" ' We saw a Skylark fly after and catch a Gold-tail moth, which had flown out of the thorn-hedge. The Lark took the moth to the ground, apparently devoured a portion of it, and then flew off with remainder.'

" Then my note goes on with a quotation from your book † about Gold-tails and Satin moths, and [refers to] the numbers of Gold-tails noticed resting on the stocks of the thorns."

Attacks of Common Wasps upon butterflies : wasp carrying off a spider's prey. By Prof. E. B. Poulton.

I am inclined to think that these attacks may be insufficiently appreciated ‡ and that the wings of butterflies found under flowering shrubs may often have been removed by wasps. Careful examination of the marks at the extreme base would probably settle the question. Further observations would be of much interest, especially if directed to the details of the actual attack and conveyance to the place where the wings are removed and the body carried off piecemeal.

On 31 August of the present year my grand-daughter Penelope Poulton and I watched at close quarters a worker of one of our common wasps at work on a fine " Red Admiral " butterfly which lay lifeless on the drive of St. Helens Cottage, St. Helens, Isle of Wight. How did the butterfly reach this spot ? It was an immense load for a worker of ordinary size. No flowers were near at hand, and it is most probable that the butterfly was seized and disabled while resting on a tree or part of the building and that the wasp and its victim reached the ground together. The butterfly lay on its side and the wasp, quite undisturbed by our presence, was gnawing in the most business-like way, close to the hinges of the left two wings. I regret that I did not wait to watch the rest of the performance, but a human meal was due and when I returned after it, the only remains that could be found were the L.F. and R.H. wings exhibited to the meeting. These had been blown by the wind to the middle and opposite side of the drive respectively. The body must have required at least two or three journeys, and I wish that I had seen them and noted the intervals.

About a fortnight later, after I had left St. Helens, Christopher observed another attack on a female " Small Garden White " which was lying on a path in the same garden. He has given the following account of the performance.

* I may add that I have now received evidence that the Gold-tail moth is sometimes, although evidently very rarely, taken by bats.

† 1890, " Colours of Animals," Lond., pp. 241–3.

‡ Mr. J. A. Simes' observations (p. 66) show how important they may be under certain conditions.

" I was walking along one of the paths and returning in about a minute saw upon it a wasp dealing with a butterfly which it had evidently killed during the interval. Where it caught the butterfly I can't imagine for there was no sign of either when I first passed. However, having heard how interested you were with another wasp chopping up a butterfly, I watched. The wasp balanced one of the wings in a vertical position and then gnawed sideways along the hinge. When the wing had fallen it tried to fly away with the butterfly but found the load too heavy, and so landed about a foot from the first position. Here it chopped off the other wing which also was held vertically, and then removed the legs, cut the body in two and flew off with the front section, a comparatively small load. I then left the spot but returned in about three minutes and collected the remains [exhibited to the meeting]. I am not sure whether I found all the legs, but I did my best. I do not think that the whole incident occupied much over two minutes. The wasp seemed to know exactly what to do, except about carrying or trying to carry away the whole butterfly with only one wing off."

In this account of the wasp's behaviour it is evident that " the wing " referred to included the hind-wing as well as the fore. It is also probable that the object of the short flight was to turn the butterfly over so that the wings of the other side could be dealt with. It is interesting that no attempt was made to raise the wings of the much larger and heavier " Red Admiral."

There are tall herbaceous plants near the spot where Christopher observed the incident, and it is probable that the butterfly was killed on a flower and that the wasp then flew or floated with it down to the path below. I do not know whether the sting is employed in these attacks, but the complete and rapid immobility of the victim suggests that this is probable. The nearly fresh female *P. rapae*, exhibited to the meeting, was sent to me by Miss Godman who found it, 5 Sept. 1934, on the lawn at South Lodge, Horsham. Except for a very small notch in the R.H. wing there are no apparent injuries such as we should expect to find after a bird's attack, and it appears to be not improbable that the butterfly was killed by a wasp which was disturbed before dis-winging its victim.

My friend Dr. Eltringham has sent me the following account of a wasp's success in obtaining prey of a very different kind and in a very different manner :—

" I saw an interesting sight on September 15 [1934] at my brother's house at Missenden. A wasp hovered round a window-frame and found a ' Daddy-long-legs ' fastened up by a spider. The spider was not in evidence, evidently thinking discretion the better part of valour. The wasp cut the threads and the wings away, and then rolled up the body of the fly with its feet and flew away with it. It is the first time I have seen a wasp raid a spider's larder."

Observations on the Thomisid Spider *Misumena vatia* Clerck. By Prof. E. B. Poulton.

The following observations on this " crab-spider " were made close to the entrance to Whitefield Woods, Eastbourne, 17 June, 1934 :—

A large white example, harmonising with a small flower-head of the " Hemlock Water Dropwort " (*Oenanthe crocata*) in the centre of which it was sitting, remained

indifferent to the presence of two active Longicorn beetles of distinct species which were passing to and fro close to it; also of minute Diptera which were equally available. One of the beetles even distinctly "pawed" the spider's abdomen in passing, without evoking any response. I then saw that it was holding a small insect, probably Dipterous, but reduced to a minute black lump. I boxed it and its prey with a part of the flower-head. This was a mistake, as other insects, both living and the remains of prey, are likely to be present, so that a determination of the prey seen to be devoured becomes difficult or impossible. If this species of Thomisid accepts such Longicorn beetles, the observation appears to show that it does not drop a small capture in order to take a much larger one.

A little later, another white Thomisid of about the same size but with rather less of the small red spots on the abdomen, which appear to enhance the cryptic effect, was seen on another flower-head of *Oenanthe*, devouring a rather larger Dipteron. Tapping with a grass-head produced no apparent effect until this was repeated rather roughly when the spider slightly shifted its position. When visited a few minutes later it had dropped its prey which lay, a small shapeless object, on the flower-head. The spider then remained motionless for some minutes, facing upwards with outspread anterior legs, in the centre of the slightly tilted inflorescence. It then turned round and faced downwards and later again upwards, when a small Dipteron, larger than the last one, alighted near it. The spider cautiously crept towards it and seized it. The flower-head and its inhabitants were then boxed. These last observations, carried on after the spider was visited a second time, occupied about 15 minutes between 12.0 and 1.0 p.m. I was interested to see that the spider did not merely lie in wait for its prey but approached it.

The above observations were made in the lane just outside the entrance. A third Thomisid, devouring the relatively large green Sawfly, *Tenthredella mesomelas* L., ♀, was found on the upperside of a bramble leaf in a little clearing just inside the wood, close to the entrance from the lane. It was also white and harmonised with the unopened flower-buds and white undersides of the bramble-leaves.

Two young Thomisids, also white, were collected from another part of the same bramble-bed in the clearing.

The sexes of the species captured by these flower-haunting spiders is of much interest. Although often recorded, as by Mr. Simes on p. 67, and by Dr. B. M. Hobby,* far more extensive data are required, as also of the insects captured by wasps.

The Arachnida found so commonly at the North Cape in July 1933 (1933, *Proc. R. ent. Soc. Lond.*, **8** : 112) and believed to be the enemies which attacked weevils under stones, have been determined by my friend Dr. A. R. Jackson, as the Opilionid, *Mitopus morio* Fab., which "has an immense distribution, including a good deal of the arctic, but not Spitsbergen." On the subject of the method by which the weevils may be devoured (*ibid.* p. 113), Dr. Jackson wrote, 1 Sept. 1934 :—

"I fear I know nothing of the digestive processes of Opilionids. They do not of course *as far as is known* inject fluids through their chelicerae, like spiders. On

* 1930 (1931), *Proc. ent. Soc. Lond.*, 5 (3) : 107–110. See also F. H. Haines, 1933, *J. ent. Soc. S. Engl.*, 1 : 102, 103.

the contrary, these organs are chelate. They are rather highly chitinised and could, I think, easily sever a weevil at the junction of thorax and abdomen. In consequence, the contents of the thorax and abdomen respectively could be sucked up into the pharynx, without invoking the aid of an external digestive ferment."

The Kingbird feeding young on dragonflies and butterflies; also selecting stingless drones; the American Goldfinch devouring white moths. By Prof. E. B. Poulton.

My old friend Dr. William Beebe, writing 21 Aug. 1934 from St. George's, Bermuda, has interrupted the work on his exciting and most interesting adventure to tell me of the following excellent print :—

"I take time off from my notes on my half mile dive to call your attention to the photograph in 'Bird-lore,' July–Aug. 1934, **36 : 230**, of a Kingbird feeding a butterfly to its young."

My friend Mr. N. D. Riley agrees with me that there is no doubt about the butterfly represented being *Basilarchia astyanax* Fab. The under surface of the L.F. wing and the margin of the R.F. wing upper surface appear to present conclusive evidence. The print reproduces a photograph taken by the author, Raymond S. Deck of New Rochelle, N.Y., whose paper, "My Connecticut Sanctuary" (pp. 226–231), also records the regular feeding of the Kingbirds' young on dragonflies. Thus, when watching one particular nest, the "parents flew down, singly or together, with the inevitable dragon-flies" (p. 227). Also on p. 229 :—"Dragon-flies of many sizes and colors and big black butterflies were the staple diet. . . . I saw practically no inclination to molest the numerous bees and wasps, but no doubt that was because meatier insects could be readily had. Kingbirds—known as 'Bee-Martins' in the South—often feed largely on honey-bees, usually selecting the stingless drones."

The following observation on the American Goldfinch, pointed out to me by my friend Dr. J. G. Myers, may be conveniently added to the above.

"Last Sunday morning when I came home from church, as I entered my yard I noticed the lilac bush in front of our door was filled with little white moths flitting around. Thinking nothing of it, I went into the house. It was not long before the sun got around to shine on the bush, and this made the moths scatter here and there. A few moments later I heard a bird chirping in front of the house. I walked quietly in the direction of the door, and, to my surprise, there was a Goldfinch devouring those little winged creatures.—Helen Thomas, *Flushing, N.Y.*" (July–August, 1933. *Bird-Lore*, **35 : 238**.)

Butterflies attacked by bee-eaters in S.W. India : Protective devices of caterpillar and associated Phytophagous beetle. By Prof. E. B. Poulton.

Prof. Poulton communicated some interesting observations, recorded by E. L. Arnold,* to which his attention had been directed by his friend Mr. J. A. Simes.

* "On the Indian Hills" (New Ed.), Lond., 1893.

The following, made near Calicut, confirm Col. C. T. Bingham's notes on Burmese bee-eaters.*

" Of butterflies when the sun got warm many kinds appeared, the commonest being the small saffron-coloured *Terias hecate*, and the handsome black-and-crimson swallow-tail *Papilio pammon*, which seemed, by the way, to be the principal victims of the graceful green bee-eaters, a pair of which had their perches on the woodwork of a disused well, and every now and then made rapid darts at passing insects. They never missed their prey, and always brought their quarry back to the same spot to be dis-winged before being swallowed, the ground under their watch-towers being thickly strewn with gaily painted shreds of unfortunate butterflies and bees " (pp. 99, 100).

It is difficult to trace the locality of the second observation, apparently made at the author's coffee estate—Pardagherry, reached, by way of Beypore and Palghaut, from Calicut. He describes on pp. 296, 297 a steel-blue phytophagous beetle, about the size of a pea, associated with yellow-and-black caterpillars, one of which, when approached, had " left off feeding, thrown itself back on its rear claspers, and violently swung its body from side to side. At this strange movement, which might alone repel a bird, a gentle vibration has been communicated to the neighbouring twigs and leaves, and the blind-looking beetles have hastily let themselves drop to the ground, where they are quite safe; while, after passing the signal rapidly round the bush, so that every twig at last was in a tremble, the caterpillars would each take a turn round the nearest belaying-pin, and let themselves down after their strange associates by a thousand silken threads."

***Bembex regnata* Parker, preying on Butterflies.** By Robert B. Benson.

This observation has come into my hands through Mr. N. D. Riley and is taken from recent correspondence received at the British Museum from Captain R. H. R. Stevenson of Southern Rhodesia. The Bembecidae (Sphecoidea), as is generally known, do not as a rule seal up the cells containing their larvae, but feed them from day to day on freshly caught insects. The insects caught are generally Diptera, but representatives of other orders are also used. Captain Stevenson records that *Bembex regnata* Parker regularly catches butterflies, usually species of *Terias* (Pieridae) and small Hesperiidae, but sometimes Nymphalinae, for example once *Charaxes etheocles* Cram., ♂, and once *Pyrameis cardui* L., and also once a Hesperid of middle-size, *Abantis zambesiaca* Westw.

Mention should here be made of the observations by Professor G. D. Hale Carpenter recorded in 1917 *Proc. ent. Soc. Lond.*, **1917 :** xli–xlii, where he describes watching a species of *Bembex* preying on Hesperiidae in Uganda. Unfortunately in this case the *Bembex* species was not ascertained as it escaped uncaptured, nor were the butterflies named. In the same part of the *Proceedings*, pp. xxxviii–xl, are recorded observations by Dr. Bondar on the Bembecid *Moncdula* (*Stictia*)

* Poulton, " Essays on Evolution," Oxford, 1908, pp. 287, 288. On pp. 282–292 of this work a number of bird-attacks on butterflies are recorded, many of them extracted from the notes of Col. J. W. Yerbury and Col. C. T. Bingham. These and the observations described on p. 282, *n.* 1, were inadvertently omitted in recent discussions on this subject.

adonis Handl., preying on HESPERIIDAE in south-east Brazil with a reference to a previous observation on the storing of butterflies by wasps in Belt, 1880, " The Naturalist in Nicaragua " (2nd edit.) : 109.

Some exotic Coleoptera recently taken in Britain. By Dr. K. G. BLAIR.

Two interesting cases of exotic beetles taken at large in this country have recently come to my notice. *Megadytes costalis* Aub., a native of Brazil, was found dead in the mud of a pond at Mill Hill by W. O. Steel, and *Ochotyra testacea* Pasc., a Rhagophthalmid from S. India, was found by Dr. A. H. Newton crawling on the short grass at the top of the cliff near Brightstone, I.W.

Mr. E. C. BEDWELL announced the capture by himself of the Oriental *Anthicus tobias* Mars. in a wood near Malling, Kent.

The true Nature of the Hypopharynx in Blood-sucking Arthropods. By S. K. SEN.

The observations recorded below were made on the tick *Ornithodorus papillipes* and as such, they might, at the first sight, seem out of place at an entomological meeting, although, judging from the contents of entomological text-books and periodicals, the subject of Arachnids does not appear to be excluded from the purview of entomological science. However, as will be seen from what has to be stated later, the present observations apply not only to the tick, but to the entire range of blood-sucking Arthropods and, moreover, they are such as to be quite unexpected and contrary to established views on the subject.

As is well known, the sucking apparatus in ticks is believed to be formed by a pair of chelicerae, or the so-called mandibles, and the hypostome, although an actual mouth-opening has never been observed, nor has it been explained how such dissimilar structures can combine to form the sucking tube. For some time past, I have been carrying on a detailed study of the anatomy of *O. papillipes*, which has been incriminated as the transmitting agent of surra (*Trypanosoma evansi* infection) in India. In the course of these studies, I encountered a stylet overlying the dorsal gutter of the hypostome, the latter representing an extension of the basis capituli. On following up the stylet by dissection, it proved to be, to my great surprise, the tubular continuation of the pharynx itself, and I even succeeded in detaching intact the entire structure, from the proximal end of the pharynx to the distal point of the stylet.

The stylet is provided with a well-defined lumen and a distal orifice and it is remarkably refractile which, perhaps, accounts for the fact that it has escaped observation by other workers. It is resistant to the action of caustic potash and, I think, undoubtedly represents the homologue of the hypopharynx in blood-sucking insects. This discovery at once points to the conclusion that the sucking apparatus in the biting Diptera is not formed by the apposition of the labrum-epipharynx and the hypopharynx as has been hitherto supposed, but that it is a tubular extension of the pharynx itself; that the buccal chamber is not formed by the walls of the exo-skeleton, but is an entity by itself, being entirely separate from the exo-skeleton, except for the intervening connective tissues and chitinous plates; and, lastly, that the lumen of the sucking stylet in biting flies is, in all

probability, what has, till now, been regarded as the hypopharyngeal extension of the salivary duct.

A short communication on the finding of this organ has been forwarded for publication in *Nature* and a detailed paper will be published elsewhere in due course.

Papers.

The following papers were read :—

" A study of the colonisation of *Aphelinus mali*," by H. T. Rosenberg.

" The genus *Pintalia* Stål," by F. Muir.

" Further experiments on coloration and relative acceptability of insects to birds," by F. Morton Jones.

" Notes on the behaviour of the larval communities of *Perga dorsalis* Leach," by J. W. Evans.

" Classification of the sawflies of the family Pterygophoridae," by R. B. Benson.

" The American species of the genus *Trypoxylon* (Hym.)," by O. W. Richards.

Wednesday, 17th October, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

Election of Fellows.

The following were elected Fellows of the Society :—Captain Robert Alured Denne, Junior Naval and Military Club, 96, Piccadilly, W.1; S. S. Malik, Kashmir Forest Service, Srinigar, Kashmir, India; Nellie Freebairn Paterson, Department of Zoology, University of the Witwatersrand, Johannesburg, S. Africa; E. Graywood Smyth, Hacienda Cartavio, Trujillo, Peru, South America; Sir Thomas Stanton, K.C.M.G., Colonial Office, Downing Street, S.W.1; C. B. Symes, Medical Research Laboratory, P.O. Box 41, Nairobi, Kenya Colony.

Obituary.

The death of Mr. M. L. Thompson, elected a Fellow in 1901, was announced.

Exhibits.

The following communications were then made to the meeting :—

A dark specimen of *Eumenis semele* L. and a beetle new to Britain. By H. St. J. K. Donisthorpe.

On 1st August, 1933, I took a specimen of *E. semele* which is much darker on both upper- and undersides than any specimen in the British Museum collection of British Lepidoptera.

On 26th June, 1934, Mr. J. R. le B. Tomlin took 2 specimens of *Ebaeus abietinus* Abeille, in Moccas Park, Herefordshire. This record makes an addition to the British List, although representatives of the genus have previously been recorded.

Movements of the ptilinum in newly-emerged tsetse-flies. By D. J. Lewis.
(Communicated by Prof. P. A. Buxton.)

The following notes on the movements of the ptilinum and other parts of the body in newly-emerged tsetse-flies, *Glossina tachinoides* and *G. submorsitans*, illustrate the importance of this organ in enabling the insect to burrow upwards through the soil in which the pupa was buried. A regular cycle of movements occurs which occupies five seconds or less. The head is laterally contracted so that it becomes wedge-shaped and at the same time is pushed forwards. The ptilinum then becomes fully expanded, the compound eyes being forced so far apart that the head becomes broader than the thorax. This is followed by a powerful longitudinal contraction of the body, the head and thorax being pressed tightly together. The ptilinum is deflated, the head is again contracted laterally and the series of movements is repeated. At the initial contraction the area between the eyes is folded and narrowed to a fraction of its normal width (to about twice the diameter of one ocellus). The full expansion of the ptilinum involves the whole head, so that its size is seen to be considerably increased from whatever direction it is viewed. For instance, the whole ocellar region as far back as the vertical bristles is raised above the level of the eyes. During the contraction of the thorax a deep transverse fold appears on each side of the mesothorax.

The evident result of these movements is that the temporarily wedge-shaped head is forced into a space between the soil particles and then becomes firmly fixed there by expansion, after which the thorax and abdomen are drawn after it. A newly-emerged fly placed between sand and glass is seen to move forward only when the ptilinum is expanded, while the motionless legs are drawn through the tunnel bored by the ptilinum.

Six freshly emerged adult *G. submorsitans* were placed beneath one inch of sand (grains 0·2–1 mm.). They rapidly reached the surface, which showed regular movements corresponding to the pushing forward of the head. Four flies in which the ptilinum had ceased to expand failed to reach the surface.

The ptilinum generally continued to expand for more than thirty minutes after emergence.

The number of generations of *Pieris rapae* L. in Southern England. By O. W. Richards.

It does not appear to be very well established how many broods of *P. rapae* there are in this country. South (1906, *British Butterflies*, p. 37) and Barrett (1893, *Lepidoptera of the British Islands*, **1** : 23) state that there are two broods and South adds that in exceptional years there may be a third. Frohawk (1924, *Natural History of British Butterflies*, **1** : 19) states that there are broods in May and July and sometimes one in August–September.

Observations made at the Imperial College Field Station, Slough, Bucks, during the summers of 1932, 1933, and 1934 suggest that there are regularly three broods. In 1934, complete observations on the number of eggs present on a certain row of cabbages were made between the end of April and the end of September (except between 22nd June and 8th July). During these months there were three distinct, non-overlapping oviposition periods, viz. approximately 14th May–21st June, 9th July–9th Aug., 23rd Aug.–2nd Oct. Observations in 1932 and 1933, though not so complete, provide comparable data.

According to Querci (1932, *Ent. Rec.*, **44** : 168-176) *P. rapae* has eight broods at Philadelphia, but the flight periods of all the later ones overlap. The method of counting the number of eggs present would not reveal the existence of such overlapping broods, unless the counts were made on a very large scale. But there is at least little indication of more than three broods at Slough.

Attacks of birds upon butterflies in the Solomon Isles. By Prof. G. D. Hale Carpenter.

The following specimens were exhibited, captured by Mr. R. A. Lever, F.R.E.S.

(1) *Hypolimnas alimena salomonis* Ribbe. A male from Ulawa I. May, 1934. The tips of both fore-wings are rubbed and slightly torn : on the left side there are some sharply-marked scratches and a very clear triangular imprint, visible on both sides, directed from the third vein forwards and outwards towards, and almost reaching, the apex. The line of the mark leads backward to the hind margin of the wing which is broken away posterior to vein 1, suggesting that the beak was passed forwards from the hind margin, and that it was a long one whose tip only is shown on the wing.

(2) *Danaida affinis cornetho*, G. & S. A female from Su'u, on the west coast of Malaita Isle, May 23rd, 1934. Both hind-wings are notched, on the left side at the end of vein 3, on the right at the end of vein 4. A large triangular mark, visible on both sides of the wing, commences from vein 4 on the right wing and is directed towards the anal angle, its posterior limb running from the notch on the hind margin. There is also a wide notch on the outer margin of the left front wing, and the upper surface is scratched. Both specimens are in the Hope Department of the Oxford University Museum.

An association of black and white butterflies from Mt. Mlanje, Nyasaland. By Prof. G. D. Hale Carpenter.

A collection has been presented by Dr. W. A. Lamborn, O.B.E., F.R.E.S., to the Hope Department which consists of butterflies captured in May, 1934, "in one ravine on Mlanje Mountain by Bisenti, Neave's former head-collector, who was instructed to obtain black and white butterflies only, for I hoped that I might be able to get a series of the fine black and white *Pseudacraea*. But luck was out." Dr. Lamborn wrote in a letter of later date : "The boy was instructed to collect all black and white butterflies, not specially to concentrate on *niavius*-like forms." This last remark was in answer to a query after first inspection of the consignment, which revealed a high proportion of such forms. The numbers of each species are given in the following table.

Amauris niavius dominicanus Tr., 42.
Amauris albimaculata hanningtoni, Butler, 1.
Hypolimnas dubia wahlbergi Wallengr., 25.
Hypolimnas dubia nr. *daemona* Stgr., 1.
Pseudacraea lucretia expansa Butler, 1.
Pseudacraea lucretia lucretia Cr., 1.
Papilio dardanus cenea, Stoll., ♀ f. *hippocoonides* Haase, 1.
Pseudacraea deludens Neave, 2.
Planema aganice nyasae Carptr., ♀ 5. (♂ 3 not entering the association).
Papilio echerioides Trim., ♀ 1.

The predominant members of the association are *dominicanus* and its chief mimic, *wahlbergi*. The form *expansa* of *Pseudacraea lucretia* fits well into the scheme owing to the enlarged white areas, and the local race of *Planema aganice*,

in the female sex, does so for the same reason. The rarity of the spotted type of coloration at the time of the collection is remarkable: only one *Amauris* was captured. In a paper on *Acraea johnstoni* (1932, *Trans. ent. Soc. Lond.*, **80**: 263) the writer commented on the development of the spots in specimens from Mt. Mlanje, and noted that in Nyasaland "there is a large *Amauris* population with strong white markings of the type shown in *A. dannfelti*." It therefore appears that these numerous spotted *Amauris* were temporarily in abeyance at the time that Bisenti collected: it is also of interest that spotted forms of *Hypolimnas dubia* were also greatly in the minority compared with those mimicking *dominicanus*. The one specimen taken is remarkable on account of the very large white area of the hind-wing which almost equals that of the *wahlbergi*: it comes nearest to form *daemona* Stgr., which is of the *western* race of *dubia*. The submarginal spots on both wings are large and clear: the large discal spot in area 2 has a small white streak behind it in the outer half of area 1*b*, but the remainder of areas 1*a* and 1*b* is without white save for the submarginal dot. There is a slight suffusion with white scales at the extreme base of area 3, in the angle. The white spot in the distal end of the cell is large, and there is a small one nearer to the base.

The two *Pseudacraea deludens* are quite typical: the model for this wonderful mimic, *Amauris lobengula whytei* Butler, was not taken.

The two specimens of *Pseudacraea lucretia* fall under the two headings. The example of form *expansa* shows the great enlargement of the white markings across the disc of the front wing, and also the slight touch of yellow brown at the anal margin of the hind-wing with very large white area, which distinguish this form and cause the specimen to resemble the predominant *Amauris*. The other specimen, although the discal spots of the front wing are somewhat enlarged, is nearer the type, *l. lucretia* than *expansa*, and has the subapical spots of the fore-wing larger in proportion than has *expansa*, so that it more resembles the spotted type of model.

Bird-feeding experiments in 1934, on Martha's Vineyard island, Massachusetts: the return of the "17-year Cicada" to the island: notes on two of its butterflies. By Dr. Frank Morton Jones.

[Prof. Poulton said that the following observations and experiments were described in a letter written by his friend at Vineyard Haven on the island. He felt sure that they would be of the greatest interest to our Fellows and had therefore obtained permission to communicate them to the Society.]

31 *Aug.* 1934.—Bird-feeding experiments have been continued as material was obtainable; but by some shift of bird-populations, nesting birds were not so much in evidence, close by; and most of the insects offered to those present were of species employed in earlier experiments, with results fully in accord. I have just succeeded in trying out one insect, however, for which I have been watching rather anxiously. This is the brightly-coloured day-flying Arctiid, *Utetheisa bella* L. which is one of the four moths illustrated in my forthcoming paper of which you have just sent proofs. In my Florida experiments, results with this insect seemed significant and conclusive; but I wished to try out this widely-distributed insect with northern bird species. Just now, *bella* is appearing in considerable numbers, and I have been able to procure fresh material. In two experiments (August 29 and 31), I placed on the tray moths of the following families:—

Arctiidae	(*U. bella* L.)	10 examples	1 species
Notodontidae		2 ,,	1 ,,
Noctuidae		19 ,,	7 ,,
Geometridae		3 ,,	2 ,,
Lymantriidae		6 ,,	1 ,,
Yponomeutidae	(*A. aurea* Fitch.)	2 ,,	1 ,,
		42 ,,	13 ,,

U. bella and *A. aurea*, as indicated in my second and first papers respectively, are gaudily coloured; all the other moths were of dull greys and browns. The first experiment was terminated in 11 *minutes*, the second in 35 *minutes*. In these periods, the tray was visited by Towhees and Song Sparrows, the former including old birds and young birds sometimes feeding themselves and sometimes being fed. In the stated periods, *all* the dull-coloured insects (30, of 11 species) were taken, and *not one* of either *bella* or *aurea*, though of the former species one insect had been picked up, a front wing torn off, then dropped again on the tray otherwise unmutilated. I'd like to try these insects with the other frequent tray-visitant, the Blue Jay; but of course I cannot control the order of visits of the different birds, and I never know which will come first.

This was "Locust Year"—the year for the appearance of the 17-year cicadas (*Tibicina septendecim* L.)—on the island. They appeared on schedule, in early June, in the same restricted areas they were noted to inhabit, seventeen years ago, and the air was full of their song into early July. Appearing before other cicada species (which too are difficult to procure in numbers), I made no effort to determine their relative acceptability to birds. Though their coloration might be interpreted to have some warning significance, they are of more sluggish habit, rather inactive and of slow and uncertain flight, in comparison with other cicadas. Here on the Island, they inhabit the dry central portion where for many square miles the ground is covered with dense growths of "scrub-oak," which reaches a height of only a few feet. Here the cicadas appeared in countless numbers, and an interesting response to "numbers and availability" (McAtee) became evident: scores of seagulls came inland and coursed over the tops of the scrub-oaks, snapping up the cicadas as they rose from the herbage in clumsy flight. I did not see any actual capture, for the scrub is almost impenetrable; but I did see the gulls engaged in these unusual manoeuvres, and I have no doubt the interpretation put upon these by observers in the local newspaper was correct, and that they were attracted to these inland wastes by the great assemblage of the 17-year cicadas, which too must have been an entirely unfamiliar insect to the gulls.

This summer I constructed a large screened cage over a wild-cherry bush, and have been attempting to breed Basilarchias (*astyanax*) in considerable numbers—thus far without marked success, for more than half of the eggs laid by the females of the first brood develop into hibernating larvae. Here on Martha's Vineyard, white-banded and intergrading forms turn up at intervals, and any considerable series shows interesting and suggestive variations. *Papilio philenor* L., due to the planting of a cultivated *Aristolochia* (*sipho*), is no longer a rarity here, though I believe that in T. W. Harris's time it was supposed to be a rarity in New England. Its survival here (as pupae) through the last winter, with temperatures down to 18

below zero Fahrenheit, shows that its northern distribution is not limited so much by temperature as by food-plant distribution.

The " homing " of a female Noctuid moth, *Luperina testacea* Schiff. By Prof. Poulton.

This remarkable instance of homing was observed by the Registrar who has kindly recorded the details as follows :—

" The moth which I gave to you at the Conversazione was caught by me on 10.ix.34. It has been a regular visitor to a glass door to our house at Hampton Hill for three weeks and always appeared on the same pane of glass at approximately the same time, 9.0 p.m. I am satisfied that the specimen I gave you is the one which visited us so regularly, as I caught, examined, and released it several times during the three weeks. The door faces due south and gives access to the garden in which are a number of fruit trees."

The door contains twelve panes of equal size arranged in three vertical rows of four each, and the moth always settled in one upper corner of the third pane from above in the middle row. It was thus in one of the four most centrally placed corners, but it never chose any of the other three. The most probable interpretation of its behaviour is that it was attracted by light, but the choice of one single corner awaits explanation. This is in fact the only instance known to me of a moth constantly seeking one precise resting-place when thus attracted. All other examples have been of nocturnal insects choosing spots on which to rest by day or of diurnal insects choosing one for rest by night; also of associations of aposematic species joined by late-comers. Prof. Hale Carpenter had suggested the possibility of the glass in the favourite corner being cracked or irregular in some way so as to cause an increased brightness in the light shining through, but the Registrar informs me that he could observe no such effect. He also remembers that the moth returned to the spot very soon after being liberated but the course of its flight was difficult to follow in the light and shade outside the window. He believes that it did not remain on the glass all night, but had not noted the duration of its visits.

Mr. Donisthorpe suggested that the behaviour of the moth might be compared with that of *Coccinella bipunctata* L. described by Miss F. J. Kirk in 1924, *Ent. Record*, **36** : 9–10. These " Lady birds " hibernated in a crevice in the plaster of a bedroom ceiling, and although in warm weather they would leave this and fly about the room for hours at a time, they always returned to the same retreat.

Bees, visiting Orchids at Valescure and in Jersey, captured by Col. G. H. Evans, C.I.E., C.B.E. By Prof. E. B. Poulton.

Col. G. H. Evans in his letter of 1 Oct. 1934, has written the following notes on the specimens exhibited :—

" I am sending you a few bees which M. Berland kindly asked M. R. Benoist, a specialist on bees, to identify.

" *Anthidium septemdentatum* Latr., ♂ : taken on *Ophrys atrata* at Valescure : 3.iii.32. I have only once before seen a bee go to *atrata* ; he extracted the pollen but I was not quick enough to take him. *Ophrys atrata* is, I should say, easily the commonest *Ophrys* in Valescure, and the earliest. I have watched the plants for

hours time and again, without seeing a bee at work on them. I have once taken *A. septemdentatum* on the flower of *Serapias cordigera* at Valescure (1928, *Proc. ent. Soc. Lond.*, **3** : 38).

" *Andrena nigroaenea* Kirby : taken on *O. arachnitiformis*, at Valescure : 3.v.32, I think I sent you a specimen of this bee taken on *O. arachnitiformis*, in 1930 (1930, *Ibid.*, **5** : 102).

" *Anthrophora acervorum* F., ♂ : taken on *Orchis morio* : 11.v.34 : Jersey, C.I. I have watched this plant for many years and have never seen an insect visit it before, but this bee visited 3 or 4 flowers and was not in the least perturbed by my presence.

" The other two bees were taken on *Orchis longibracteata* at Valescure : 9.iii.32. One is *Bombus terrestris* L., ♀, the other *Apis mellifica* L., ♀. These seem to be regular visitors to this plant. I have seen the Carpenter Bee *Xylocopa violacea* L. go to this orchid and extract pollinia, but did not take him. All the bees now sent bore pollinia from the plants noted.

" Watching the bees concerned with the fertilisation of orchids is a very slow business : somehow we have not hit on the time when they visit these flowers. One finds pollinia extracted from any number but can spend hour upon hour without luck."

Bees visiting orchids and captured by Col. G. H. Evans or his friend Col. M. J. Godfery, F.L.S., are recorded in *Proc. ent. Soc. Lond.*, 1928, **3** : 38, 60; 1929. **4** : 106; 1930, **5** : 101; 1931, **6** : 59, 70. References to M. M. Pouyanne's remarkable observations on the fertilisation of Algerian orchids, confirmed and extended by Col. Godfery, will be found in *Ibid.* 1927, **2** : 31; 1928, **3** : 10; 1930, **5** : 49.

The Procryptic Resemblance of a New Zealand leafhopper to its food-plant. By Prof. Poulton.

I am sure that the Fellows will be interested to see the photograph sent to me by my friend Dr. J. G. Myers who wrote from Trinidad on 30 April, 1934 :—

" I enclose a photograph I have just found among my New Zealand records, of a leafhopper (*Cephaelus hudsoni* Myers) on its sole known food-plant, the jointed rush, *Leptocarpus simplex* A. Rich. It is a remarkable case of cryptic form and colouring."

Observations on *Laternaria*. By Dr. J. G. Myers.

(Communicated by Prof. E. B. Poulton.)

In the absence of any modern credible witnesses, the controversy as to the luminosity of insects of this genus is presumably resolved by assuming that Madame Merian's famous observation was based on confusion with *Pyrophorus*. Nevertheless the following alleged record of luminosity may be of interest, while the other observations bear on the recent suggestion of Prof. Poulton that the insect is an alligator-mimic.* .

An alleged witness of luminosity.—That very competent zoologist, J. J. Quelch, in his account of the 1898 Roraima expedition prefaced to the second volume of Chubb's *The Birds of British Guiana* (London, 1921, p. xlvi) records the following :—

* *Proc. ent. Soc. Lond.*, **1924** : xliii, xlix. See also *Ibid.* 1927, **2** : 86; 1932, **7** : 68.

" It was quite an event to get a record of the true large lantern-fly (*Fulgora*) in one of these forests of the sandstone plateau. The species is known by the name ' Anarowa ' among the Makushis, and a dead specimen was brought to me by an Indian who had caught it alive in the valley. He had secured it because of the brightness of the light of the enlarged front of the head, to which he pointed; though he had been at first somewhat alarmed by it, as being some sort of kenaima or bad spirit. As the man knew nothing of the disputes as to the luminosity of the species, his testimony must be regarded as valuable and definite, although it is quite possible that the light many be dependent on seasons, as a purely sexual character. Eager search for a living one met with no success."

I took a fine specimen in 1932 in the same forest region. It sat passively on a tree-trunk surrounded by a thick circle of fluffy waxy material from the abdomen, showing that it had certainly not moved for some time, save for rotatory movements probably associated with sucking. Though the insect itself so closely resembled the bark in colour and markings, the *ensemble*, with the snow-white wax was markedly conspicuous. My Macusis, whom I had brought from the savannahs 100 miles to the south, were quite unfamiliar with the insect, and so I was disappointed to secure no traditional data on alleged luminosity or dangerous qualities. I was, however, impressed by the effect of its appearance on these Indians. They laughed—they laughed hilariously—looked again and laughed, and for several days I received deputations of both sexes to see the insect again. Through lack of a good interpreter I was unable to find what particularly impressed them as funny.

There are several reports that the forest Indians, who are familiar with the insect, hold it in the deepest dread. Thus Schomburgk (2 : 352) was told by his Indians " that in the forest at Kuamuta (Pomeroon) there lived an especially poisonous and curious creature of which they were unable to furnish me with a description frightful enough. One day they brought me the awful beast, carefully squeezed between two bits of wood, it was nothing else than the harmless glow-worm, *Fulgora laternaria*."

Martius (3 : 1115) produces even more startling testimony. He says that, while they were working on a sand-bank, several Indians, with a loud yell that a Jacarenamboya * was flying round, dashed over from the landward side of the bank, plunged into the river, and dived beneath the surface, where they remained as long as they possibly could. They consider, he states, the insect to be highly poisonous, and they took this course to avoid its bite. He definitely attributes this fear to the alligator-like form.

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Martius, C. F. P. von, 1831, Reise in Brasilien . . . in den Jahren 1817 bis 1820 gemacht von Dr. J. B. von Spix. . . . und Dr. C. F. P. von Martius . . . 3ter Theil. München. [This volume was written by von Martius after the death of his colleague.]

Schomburgk, Richard, 1922, Travels in British Guiana, 1840–1844. Transl. by W. E. Roth, Georgetown, 2 vols.

* Lingoa-geral, *Jacarenamboia* = alligator-snake. *Jacare* is strictly speaking a caiman, not a true alligator.

Lepidopterous larvae accepted and refused by the Pentatomid larva *Picromerus bidens* L. (Hemiptera). By Joseph Collins.

(Communicated by Prof. E. B. Poulton.)

A larva of the Pentatomid bug, *Picromerus bidens*, taken at Yarnton, near Oxford, on the evening of 15 June 1934, was placed in a glass-topped box already containing a nearly full-grown caterpillar of *Vanessa atalanta* L. On arriving home I found that the bug had pierced the caterpillar with its proboscis and was sucking it dry. On the following evening I collected various Lepidopterous larvae—*Arctia caja* L., *Porthesia similis* Fues., *Abraxas grossulariata* L., a green Noctuid, and *Aglais urticae* L. Early in the morning of June 17 I looked at the tin box in which all these caterpillars had been kept with the bug, and found that the latter had attacked only the *urticae* which was hanging limp from its food-plant. The *similis* and Noctuid larvae were then separated and kept with the bug for a day but were untouched. The bug was then transferred to the box containing the other larvae, to which a nearly full-grown larva of *V. urticae* had been added: this was soon devoured. Further transferences of the bug from one box to the other were made but no other larva was attacked, and finally the *similis* and *caja* caterpillars spun their cocoons in the presence of the Pentatomid. In an earlier experiment of this kind I reared the larva of *Picromerus* on house-flies, removing one wing to enable the bug to reach them. The Pentatomid imago emerged but was below the normal size.

Some Observations on Lepidoptera in East and Central Africa. By Cynthia Longfield.

On 25th January, 1934, while catching butterflies and dragonflies frequenting a small water-course on a coffee estate near Thika, Kenya, I and three companions saw a male of the common *Anax imperator mauricianus* Ramb. seize a passing female *Acraea encedon* L. Instantly after having seized it by the body, it was dropped, and I picked it up as it lay as if dead. Our presence certainly had not caused the dragonfly to release its prey, as we had none of us moved during the episode, moreover the *Anax* had been hawking up and down, just out of reach of my net, for half an hour previously, and continued to do so for some time afterwards, until finally knocked down by one of the planters with me.

A ♀ *Danaus chrysippus* Linn. form *chrysippus*, was taken near Lake Naivasha, Kenya, on Feb. 6th; it shows a long, pointed beak-mark across the torn left wings. Several species of insectivorous birds were numerous, but I did not actually see one attack a butterfly.

On 30th January Miss Fountaine and I were collecting dragonflies at a small swamp by the roadside at Meru, Kenya, close to the edge of Thoura Forest, near a little pool, when a freshly emerged specimen of *Papilio demodocus* Esper alighted on the mud at the edge of the pool. Instantly a large frog or toad leapt from the water, seized the butterfly and began slowly to devour it, wings and all. I ran across at Miss Fountaine's call, to find half the *Papilio* already gone, head first, and in about 4 seconds it had been completely swallowed, and the frog returned to the pool.

I should say the frog sat quite 3 inches high on its haunches, and it may quite possibly have been *Rana fuscigula*, common all over Africa.

On 17th February I was in the Budongo Forest, Uganda, when I saw 4 or 5 *Tirumala petiverana* Doubl. & Hew. fluttering in an excited manner about a clearing caused by the fall of a giant mahogany tree. Owing to the tangle of branches on the ground and the height the Danaines were flying, I was only able to capture two specimens. Both are males and had the brushes at the end of the abdomen fully extruded, and the scent pockets wide open, when caught. The pockets are still open a little, but the brushes were retracted at death. I could detect no scent whatever but have little doubt that a female was present, as one butterfly spent most of the time resting on the foliage of a tall tree, and only taking short flights when approached by another, but she was too high up for me to capture. At no time did I see the brushes returned to the pockets; neither did I see any acceptance by the supposed female, but possibly my presence disturbed them, or the four males got in each others way.

In the same district in Uganda I took a few males of a Satyrid butterfly *Ypthima albida* Butler, which had a peculiar manner of flying. Only one pair of wings were open at a time. The hind-wings were spread, while the fore-wings were closed over the back, giving an uncertain and weak flight. I witnessed this peculiarity on three separate days in all specimens I saw in flight.

In the same Budongo Forest was a small rocky gorge with a swiftly running stream at the bottom. On a vertical rock wall, 4 or 5 feet above the water, and absolutely dry, I found on the 18th Feb. a small assemblage of *Atella columbina* Cramer, all sitting motionless in full sunshine, with their wings closed. I could see nothing on the vertical rock to attract them, I caught 3 and they were all males. Five days later I again visited the place, and this time there were seven *Pseudargynnis hegemone* Godart on the same area of rock. They were "fluttering" their wings violently and after disturbance returned quickly and resumed their "fluttering." I took 3 specimens and they prove to be all males. I can offer no explanation of the attraction of this bare patch of grey rock on which the bright orange of both species was very conspicuous.

While selecting specimens, mostly consisting of Pierines, Danaines, Papilios and Lycaenids, from a large gathering of butterflies at a ford, I was attracted to a specimen of *Papilio pylades* Fabr., because, although unmistakably a *Papilio*, it never once "fluttered" its wings while drinking. This was so unlike what I knew of species of *Papilio*, that I watched it a long time before capturing it. It is a male and the only one I saw. Dr. Longstaff mentions 3 out of 13 species of *Papilio*, in his book, which do *not* "flutter" their wings, but *Papilio pylades* is not among them.

Dr. H. Eltringham gave a description of the brush-organs in *Lithosia griseola* ♂, and illustrated his remarks with a wax model and a lantern slide. He called attention to the interesting fact that this species afforded the first recorded British species in which there is a dust-producing apparatus analogous to that frequently found in exotic Lepidoptera. Fuller details will appear in a paper to be published in the *Transactions*.

THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

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MEETINGS

TO BE HELD IN THE SOCIETY'S ROOMS

41, Queen's Gate, S.W. 7

1935.

Wednesday, January	(Annual Meeting)	16
,,	February	6
,,	March	6
,,	,, ...	20
,,	April	3
,,	May	1
,,	June	5

The Chair will be taken at Eight o'clock.

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